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Shipfitting Practice

INSTRUCTOR'S GUIDE

PART I — Training for Beginning Shipfitters

PART II — Training for Advanced Shipfitters

Bulletin 345-A

Commonwealth of Pennsylvania
DEPARTMENT OF PUBLIC INSTRUCTION
Harrisburg
1942

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Vocational Training
for
War Production Workers

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Shipfitting Practice

INSTRUCTOR'S GUIDE

(Suggested instructional aids with special reference to Bulletin 345, "Shipfitting Practice," published by the Commonwealth of Pennsylvania, Department of Public Instruction.)

PART I — TRAINING FOR BEGINNING SHIPFITTERS
PART II — TRAINING FOR ADVANCED SHIPFITTERS

Bulletin 345-A

Prepared by

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF PUBLIC INSTRUCTION
DIVISION OF INDUSTRIAL EDUCATION

in Cooperation With

SUN SHIPBUILDING AND DRY DOCK COMPANY
CHESTER, PENNSYLVANIA

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FOREWORD

This instructor's guide was developed at the request of instructors and supervisors of war production training classes for shipfitters. The guide, first made available in mimeographed form, has been revised and sketches and photographs of "mock-ups" and similar devices added.

Although intended primarily as a guide for instructors using Bulletin 345, "Shipfitting Practice", published by the Pennsylvania Department of Public Instruction, this bulletin contains outlines and suggestions which may be of value to instructors whether or not Bulletin 345 is available to trainees.

The cooperation and assistance of the Sun Shipbuilding and Dry Dock Company, Chester, Pennsylvania, is acknowledged.

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This "Instructor's Guide" was prepared by the Chester Field Curriculum Laboratory of the Pennsylvania Department of Public Instruction, under the direction of Charles F. Zinn, Adviser, Division of Industrial Education, with the very material assistance of George M. Schaffer, Adviser, Division of Industrial Education.

This unit was completed under the general supervision of Paul L. Cressman, Director, Bureau of Instruction, and Urwin Rowntree, Chief, Division of Industrial Education.

FRANCIS B. HAAS
Superintendent of Public Instruction

October 1942

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GENERAL NOTES CONCERNING THE MANUAL "SHIPFITTING PRACTICE"

Application of the Manual

The manual, "Shipfitting Practice", is applicable to both beginning and advanced training of shipfitters. It is intended primarily for the instruction of "outside shipfitters"; that is, those shipfitters who work on and around the ways and wet basins. Many of the fundamental processes presented are also applicable to the training of "shop shipfitters". However, the need for intensive, specialized instruction has dictated that the work of the "outside shipfitter" be considered apart from that of the "shop shipfitter".

Outline of Instruction

By referring to the table of contents of "Shipfitting Practice"*, one may see in outline form both the content and sequence of instructional units which may be considered a partial outline of instruction in shipfitting. Certain selections of content and sequence of presentation are advisable for the training of beginners and for the advancement of those who have had some experience in this field of work.

Use of Sketches and Photographs

Arrangement of text material in the manual,"Shipfitting Practice", is such that students will be required to read two- and three-view drawings. Isometric drawings and photographs are included so that the student may associate more clearly structural drawings with the object in use.

*Commonwealth of Pennsylvania, Department of Public Instruction,"Shipfitting Practice," Bulletin 345.

Blueprint Reading and Terminology

A course in blueprint reading for shipfitters should be offered in conjunction with advanced shipfitting instruction as outlined in the manual, "Shipfitting Practice".

The separation of "shop shipfitting" and "blueprint reading for shipfitters" from "outside shipfitting" has influenced the selection and arrangement of materials presented in the manual, "Shipfitting Practice."

Essential terminology is presented at the time when the work outlined requires the knowledge of such terms. A separate compilation of terms and definitions of value in instructing shipfitters has been placed in an appendix. Abbreviations used by shipfitters, and welding terms with which shipfitters must be familiar, are also included in this appendix, or glossary.

DISTINCTION BETWEEN PART I AND PART II

Part I of this instructor's guide suggests information and work experiences which may be emphasized in shipfitting training for beginners. Work outlined for instruction of beginners assumes that the trainee has had little or no shipyard or shipfitting experience. Part II indicates a suggested outline for advanced instruction for the "up-grading" of workers who are employed in a shipfitting department. Advanced instruction infers that, as a prerequisite, persons have had experience as shipfitter helpers, third class shipfitters, etc.

PART I

Training For Beginning Shipfitters

PART I - TRAINING FOR BEGINNING SHIPFITTERS

Instructional Materials and Teaching Devices

Where classes in beginning shipfitting are conducted in close cooperation with shipyards, it is probable that much instructional material may be brought into the school shop or classroom. Motion pictures will be helpful, especially when visits to shipyards cannot be arranged.

The use of templates, mock-ups, patterns, models, blueprints, sketches, and photographs will add further to effective instruction of beginners. The use of practical work jobs which can be simulated in the school shop is essential. Much of the effectiveness of the instruction for beginners is dependent upon the resourcefulness of the instructor in providing these experience opportunities.

Objectives of Training for Beginning Shipfitters

1. To shorten the usual breaking-in period.
2. To develop basic skill in the use of tools and in handling materials.
3. To develop a knowledge of locations, terms, shapes, procedures, etc., pertaining to shipbuilding practice.
4. To lay a groundwork which will help the trainee to advance more rapidly in skill and knowledge as a result of his practical work experiences in the shipyard.

SUGGESTED MINIMUM LIST OF TOOLS, EQUIPMENT, AND SUPPLIES, FOR A BEGINNING COURSE IN SHIPFITTING

(Class of Fifteen Trainees)

T O O L S

1. 5 ball peen hammers
2. 5 center punches
3. Tit punch
4. Spring punch
5. Straight edge
6. 6 - 2' folding rules
7. 6 - 6' folding rules
8. 6 - 50' steel tapes
9. 6 - 6' spring steel tapes
10. 2 mauls
11. Bending lever
12. Scratch awl
13. 2' steel square
14. Combination square
15. Level
16. Declivity board
17. Plump bob
18. Back marker

E Q U I P M E N T
(Including Demonstration Objects)

1. Heavy cleat, or similar piece, weighing approximately 50 pounds.
2. Piece of sheared plate with sharp edges.
3. Assorted steel wedges.
4. Assorted dogs.
5. Yokes, made from plate, channel, or angle.
6. Flat bars and spacers.
7. Scrap piece of flanged plate.
8. Sectional model of a ship hull.

*9. Hydraulic jack and pump.
*10. Pump hose.
*11. Safety helmet.
*12. Safety shoes.
*13. Lead hose and additional section.
*14. Impact wrench (knock-knock machine.)
*15. Portable pneumatic grinder.
*16. Welding equipment
*17. Small portable arc welder for use in light tacking. Helmet, gloves, and electrode will also be needed.
(A trainee who can properly tack weld should be present when welding equipment is in use.)

18. 3/4" x 4' x 6' scrap plate..

*19. Steamboat ratchet.

20. Goggles.
21. Pads with holes to accommodate ratchet or turnbuckle, as shown in Fig. 18.
22. 5/16" x 4" bolts.
23. 3/4" x 6" x 5' board.
24. Small templates.
25. Several small wooden blocks.
26. Small wooden wedges.

*Equipment used for demonstration. This equipment is needed for specific lessons only.

S U P P L I E S

1. 10 pieces of soapstone.
2. Chalk line.
3. 5 pieces of scrap plate 3/4" thick.
4. 10 pieces of 1/8" or 3/16" scrap plate, approximately 1' x 3'.
5. 4 pieces 5/8" x 4' x 30" plate.
6. Scrap pieces of angles (equal and unequal).
7. Scrap pieces of channel.
8. Scrap pieces of bulb angle.
9. Scrap pieces of T-bar.
10. Scrap pieces of I-beam.
11. Scrap pieces of H-section.
12. Scrap pieces of half-round.
13. Scrap pieces of flanged plate.
14. Scrap pieces of corrugated section.
15. Scrap pieces of flat bar.
16. 10 steel plates, 1/8" or 3/16"x1'x3'.
17. 4 - 7/8" x 4" bolts.
18. 12 - 7/8" washers.
19. Chalk - blue and white.
20. Approximately 50 sq. ft. strawboard.
21. 5 pieces angle bar, 1/4"x3"x3"x3'.
22. Approx. 100 sq. ft. red template paper.
23. Copy of "Shipfitting Practice" for each trainee.
24. Blueprint of general arrangement plan of a ship for every two trainees in the class.
25. Several blueprints showing layout of the shipyard for which training is being given, or, blueprints of a typical shipyard layout.

SUGGESTED OUTLINE OF MINIMUM ESSENTIALS FOR TRAINING BEGINNERS IN SHIPFITTING

Time required: Approximately 60 hours of instruction, including shop talks, demonstrations, and shop practice (practical work by trainee).

1. Location of Shipways, etc., in the Yard.
2. Knowledge of Tools and Their Uses.
*3. How to Use a Hammer and Center Punch.
3A. How to Grind a Center Punch.
4. Knowledge of Shipbuilding Shapes.
5. General Arrangement of a Ship.
*6. How to Strike a Chalk Line.
*7. How to Use a Rule and Steel Tape.
*8. How to Hook up and Use Pneumatic Tools.
9. Knowledge of Other Crafts' Work.
10. Essential Shipbuilding Terms.
11. Knowledge of the Flow of Materials.
*12. Handling Materials.
13. Fundamental Processes Employed in Shipfitting.
*14. How to Apply Dogs and Wedges.
*15. How to Apply Yokes.
*16. How to Make and Apply Strongbacks.
*17. How to Use a Steamboat Ratchet.
*18. How to Use a Hydraulic Jack and Pump.
*19. How to Lay Out Plates for Shearing, Planing, and Bevel Planing.
*20. How to Lay Out Angles for Punching and Shearing.
21. Elementary Knowledge of the Lines of a Ship.
22. Declivity of Shipways.
23. Safe Practices in the Shipyard.

* *Shop Practice (Manipulative)*

Construction of This Outline

The outline presented above was developed for a very specific training objective; that is, to provide functional, necessary, and adequate instruction for beginning shipfitter trainees. It is understood that a trainee, having completed a beginner's course, will not be employed as a fully qualified shipfitter. Likely he will serve as a *shipfitter helper* upon completion of his training period. The informational topics and shop practice included in this outline, if properly presented and completed, will enable the trainee to be of definite service when first employed in a shipfitting department.

Skills and information which the trainee will not need, or which he will not have sufficient time to acquire in a short course, are not included in this outline.

The suggested outline of instruction for beginners includes two types of subject matter: (1) informational topics, and (2) shop practices involving manipulation of tools and materials. Both types of experiences are necessary.

I. *Topic No. 1* - Location of Shipways, etc., in the Yard.

II. *Reference:* Blueprint showing the layout of the shipyard for which training is being given.

III. *Teaching Hints*

A. Information to be presented:

1. Locations which the shipfitter helper should know:

a. Location of various yards.

b. Location of ways and their numbers in the yard.

c. Location of piers and wet basins.

d. Location of tool rooms in yard.

e. Location of general store rooms in yard.

f. Location of:

(1) Bolt shed.

(2) Liner shed.

(3) Fabricating shop.

(4) Blacksmith shop.

(5) Paint shop.

(6) Mold storage.

(7) Dispensaries (first aid)

(8) Stretchers, gas masks, fire extinguishers, manifolds.

B. Suggested procedure:

1. Have trainees refer to a layout of the shipyard. Discuss the location of units and the relationship existing between the various departments and the shipfitter.

2. Have students roughly sketch and note locations in yard for which training is being given.

3. In following classes review shipyard locations and the general function of the units as they affect the shipfitter.

IV. *Assignment*

V. *Time* - 3 hours.

I. *Topic No. 2* - Knowledge of Tools and Their Uses.

II. *Tools and Equipment*

1. Rules
2. 50 ft. tape
3. 2 ft. square
4. Combination square
5. Level
6. Declivity board
7. Plumb bob
8. Back marker
9. Ball peen hammer
10. Center punch
11. Maul
12. Chalk line

Supplies

Soapstone
Chalk

III. *Reference* - "Shipfitting Practice"

IV. *Teaching Hints*

A. Safety

1. Safe use of tools.

B. Information to be presented:

1. Proper name of each tool.
2. Care of each tool.
3. Tools to be supplied by trainee.
4. Sketches and descriptions of other essential tools and equipment.

Suggested procedure: Call on students to indicate use and care of tools.

V. *Assignment*

VI. *Time* - 1 to 3 hours.

I. *Topic No. 3* - How to Use a Hammer and Center Punch.

II. *Tools and Equipment*

1. 5 ball peen hammers
2. 5 center punches
3. Tit punch
4. Spring punch
5. Straight edge
6. Soapstone

Supplies

5 pieces scrap plate $\frac{3}{4}$" thick

III. *Teaching Hints*

A. Safety

1. Wear goggles when punching overhead or when punching furnaced plates.

B. Information to be presented:

1. Different types of center punches and their uses.

C. Demonstrations by the instructor:

1. Proper hammer (type and weight).
2. How to hold a hammer.
3. How to hold a center punch.
4. What to look at when hitting with a hammer.
5. Safety caution - Wear goggles when punching overhead or when punching furnaced plates.
6. Proper use of wood punch.
7. Proper use of tit punch.
8. How to write using a center punch and hammer.

D. Student practice:

1. Have trainees practice center punching under observation of instructor.
2. Have trainees practice writing with a center punch and hammer.

Suggested procedure - Have five trainees work at one time, replacing with those who have not tried.

Instructor will criticize for benefit of entire group, pointing out errors, etc.

IV. *Assignment*

V. *Time* - 1 hour.

I. *Topic No. 3-A* - How to Grind a Center Punch.

II. *Tools and Equipment*

1. 5 dull and worn center punches
2. Bench grinder
3. Goggles

III. *Teaching Hints*

A. Safety

1. Wear goggles when grinding.

2. See that wheel is in good condition and properly guarded.

B. Information to be presented:

1. Proper shape of point.

2. Reason for removing burrs from head of punch.

C. Demonstration by the instructor:

1. How to grind point of punch.

2. How to grind head of punch.

D. Student practice:

1. Have several, or all, students grind a punch.

Suggested procedure: Criticize student work for benefit of entire group.

IV. *Assignment*

V. *Time* - 1 hour.

I. *Topic No. 4* - Knowledge of Shipbuilding Shapes.

II. *Tools and Equipment*

1. Scrap pieces of shapes listed.
2. Models of shapes listed.
3. End view drawings of shapes.

III. *References* - "Shipfitting Practice", pp. 10, 11, 58, 69, 81, 107, 127.
*"Ship Erection", - Blueprint Reading insert.

IV. *Teaching Hints*

A. Information to be presented:

1. Identifying structural shapes.

A shipfitter helper should be able to recognize and name the various shapes which are commonly used in fabricating ship hull assemblies. This does not infer that he be able to read blueprints to determine shapes used, but rather that he be able to identify the actual member as he sees it in the yard.

Typical shapes which should be identified by trainees:

1. Angles, equal and unequal
2. Channel
3. Bulb angle
4. T-bar
5. I-beam
6. H-section
7. Half round
8. Flanged plate
9. Corrugated section
10. Flat bar

Suggested procedure:

1. Illustrate shapes listed, using scrap pieces of actual steel.
2. Have trainees sketch an end view of each shape.
3. Indicate essential names of parts of shapes.
4. Develop specific uses of various shapes.
5. Have trainees examine shapes, noting approximate size, weight, etc.

V. *Assignment*

VI. *Time* - 1 to 2 hours.

*"Ship Erection", Bulletin 349, Pennsylvania Department of Public Instruction

I. *Topic No. 5* - General Arrangement of a Ship.

II. *Supplies*

1. General arrangement plan for every two students.

III. *Reference* - "Shipfitting Practice", pp. 165, 166, 167.

IV. *Teaching Hints*

A. Information to be presented:

1. The general arrangement of a ship, including:

A. decks	e. tanks
b. shell	f. holds
c. bulkheads	g. superstructure,
d. flats	etc.

B. Suggested procedures:

1. Have trainees study diagrammatic sketches of tanker and cargo type vessels as shown in pages 165, 166, 167.

2. Provide every two trainees with blueprint of general arrangement plan of a ship.

3. Discuss with group the arrangement of cargo and tanker vessels.

4. At subsequent class meetings review general arrangement with trainees until it is apparent that this topic has been mastered.

V. *Assignment*

VI. *Time* - 2 hours.

I. *Topic No. 6* - How to Strike a Chalk Line.

II. *Tools and Equipment*

1. Cuttyhunk chalk line
2. Blue and white chalk
3. Mason cord
4. Scratch awl

III. *Teaching Hints*

A. Information to be presented:

1. Colors of chalk used for various purposes.

2. Kind and size of line to use.

B. Demonstration by the instructor:

1. How to hold a chalk line.

2. How to apply chalk to the line.

3. How to position the line.

4. How to snap the line.

5. How to strike a line on a horizontal surface.

6. How to strike a line on a vertical surface.

7. How to strike a line across an uneven surface.

C. Student practice:

1. Have trainees practice striking chalk lines.

2. Trainees should work in groups of three, interchanging their positions.

3. Instructor will criticize for the benefit of the entire group.

IV. *Assignment*

V. *Time* - 1 to 2 hours.

I. *Topic No. 7* - How to Use a Rule and Steel Tape.

II. *Tools and Equipment*

1. 2 ft. wood rule
2. 6 ft. folding rule
3. 50 ft. steel tape
4. 6 ft. spring steel tape

III. *Teaching Hints*

A. Information to be presented:

1. Types of rules used by shipfitters.
2. When to use different types of rules.
3. How to read rules.
4. Proper handling of rules.

B. Demonstration by the instructor:

1. How to measure with a rule.
2. How to measure with a steel tape.
3. How to measure with a spring steel tape.

C. Student practice:

1. Measure distances that have been laid off on the floor.

Suggested procedure:

Trainees work individually when measuring with a rule. Trainees work in pairs when measuring with a steel tape.

Instructor will criticize for the benefit of the entire group.

IV. *Assignment*

V. *Time* - 1 to 2 hours.

I. *Topic No. 8* - How to Hook Up and Use Pneumatic Tools.

II. *Tools and Equipment*

1. Lead hose and additional section.
2. Impact wrench (knock-knock machine).
3. Portable pneumatic emery wheel.

III. *Teaching Hints*

A. Safety

1. Grinder (portable pneumatic emery wheel).

a. Wear goggles.
b. Be careful not to wear loose clothing while working with rotating tools.
c. When grinder is not in use, turn off air at manifold.
d. Be sure there is a guard on the grinder.

2. Impact Wrench (knock-knock machine).

a. Shut off air before disconnecting wrench.
b. Insert *proper size* pin in socket before using wrench.
c. Test direction of rotation of wrench before using to be certain whether it is tightening or loosening.

B. Information to be presented:

1. Proper lubrication of pneumatic tools.
2. Sizes of sockets and their proper use.

C. Demonstrations by the instructor:

1. How to hold knock-knock machine.
2. How to hook up additional hose sections.
3. How to hook up machine to lead hose.
4. How to change sockets.
5. How to shut off air by twisting and pinching hose.
6. How to hold and use pneumatic grinder.

D. Student practice:

1. Have trainees hook up hoses.
2. Have trainees change sockets.
3. Have trainees practice pinching hose.

IV. *Assignment*

V. *Time* - 1 to 2 hours.

I. *Topic No. 9* - Knowledge of Other Crafts' Work.

II. *Teaching Hints*

A. Information to be presented:

(It is often the duty of a shipfitter to coordinate the work of other crafts. To be of maximum assistance to the shipfitter, the shipfitter helper should have a general acquaintance with the work of other crafts.)

Other craftsmen with whom shipfitters frequently work:

1. Welder
2. Burner
3. Erector
4. Stage builder and shipwright
5. Driller
6. Electrician
7. Rigger
8. Blacksmith
9. Roller, cold presser, shearer (angle and plate), and similar shop equipment operators.
10. Shop shipfitter

Suggested procedure:

1. Discuss with group the work of each craft in reference to the shipfitter's job.

2. Question trainees concerning their understanding of "shipwright", "erector", etc.

III. *Assignment*

IV. *Time* - 1 to 2 hours.

I. *Topic No. 10* - Essential Shipbuilding Terms.

II. *Reference* - "Shipfitting Practice" - Glossary.

II. *Teaching Hints*

A. Information to be presented:

1. Selected terms which the shipfitter trainees should know. (From Glossary - "Shipfitting Practice").

1. arc welding
2. aft
3. after peak
4. amidships
5. angle clip
6. athwart
7. battens
8. beam
9. berth
10. bilge
11. bow
12. bracket
13. butt
14. bulkhead
15. buttock
16. caulk
17. center line
18. chain locker
19. chock
20. cofferdam
21. corrugated
22. corrugated bulkhead
23. counter sink
24. decks
25. declivity
26. deep tank
27. dog
28. drift pin
29. faying surface
30. flange
31. floor
32. fore and aft
33. forecastle
34. forepeak
35. forward
36. frames
37. gangway
38. girder
39. ground ways
40. hatch
41. hold
42. hull
43. I-beam
44. inboard
45. inner bottom
46. intercostal
47. keel
48. liner
49. longitudinals
50. manhole
51. midship
52. offset
53. roll
54. seam
55. set
56. shell plate
57. shore
58. staging
59. starboard
60. stem
61. stern
62. stiffeners
63. straight
64. strongback
65. tack welding
66. tank top
67. template
68. transverse
69. vertical keel
70. web frame
71. windlass
72. winch

Suggested procedure:

1. Give trainees a mimeographed list of terms, requesting that each trainee briefly define those terms which he knows; or check terms in glossary which the trainee should learn.
2. Discuss unfamiliar terms with group, referring to illustrations in "Shipfitting Practice", "Ship Erection", or other manuals.
3. Following class sessions, review terms with group.
4. Indicate to group that at a stated date each trainee will be expected to be able to identify all terms.

IV. *Assignment*

V. *Time* - 3 to 6 hours.

I. *Topic No. 11* - Knowledge of the Flow of Materials.

II. *Reference* - "Shipfitting Practice."

III. *Teaching Hints*

A. Information to be presented:

NOTE: It is essential that a shipfitter helper be familiar with the flow or progress of plates and shapes from the mold loft to the point where such materials are ready for final fitting.

In that it is frequently necessary for shipfitters to enter the fabricating shop and lay out plates or shapes, it is advisable that the shipfitter helper know how to paint or mark these laid-out jobs.

A shipfitter may from time to time inquire for a part at a certain shop station and find that it has been sent on to the next process. It is the duty of the shipfitter helper to trace this part and he should know the flow of materials through the various processes.

Sequence:

1. Mold loft
2. Layout
3. Punching
4. Burning
5. Shearing
6. Planing
7. Shaping
8. Shop assembly, and delivery to shipway
9. Erection
10. Regulating
11. Lining and tacking
12. Fitting

NOTE: Separate sequences should be presented for shapes and plates.

B. Suggested procedure:

1. If possible, arrange to conduct group through shop and yard, following flow of shapes and plates.

2. If a visit to a shop cannot be arranged, describe, and illustrate on blackboard, the flow of shapes and plates, using the nearest shipyard shop layout as an example.

C. Student practice:

1. Have trainees make a diagram showing flow of plates and shapes.

IV. *Assignment*

V. *Time* - 2 to 3 hours.

TRAINING FOR BEGINNING SHIPFITTERS

Instructor's Guide

I. *Topic No. 12* - Handling Materials.

II. *Tools and Equipment*

1. Heavy cleat, or similar piece, weighing approximately fifty pounds.
2. Piece of sheared plate, with sharp edge.

III. *Teaching Hints*

A. Safety

1. Use gloves when lifting sheared plates.

2. Be careful when setting plate down, so that you do not injure fingers.

3. Avoid straining when lifting heavy items.

B. Demonstration by the instructor:

1. Proper way to lift heavy plates or weights.

(Direct attention to barbed edge on plates.)

C. Student practice:

1. Have trainees practice lifting plates or heavy cleats under supervision of instructor. Trainees work individually.

IV. *Assignment*

V. *Time* - ½ to 1 hour.

I. *Topic No. 13* - Fundamental Processes Employed in Shipfitting.

II. *Reference* - "Shipfitting Practice". (Page references are indicated below.)

Page	*Process*	*Page*	*Process*
1	Lining and Tacking	70	Lifting Flat Bracket
12	Use of Steamboat Ratchet	81	Fitting Collars and Spacers
15	Use of Hydraulic Jack	93	Correcting Welding Distortio
20	Bending of Plates and Shapes	109	Scribing Bulkhead Corrugatio
39	Use of Liners	113	Leveling with Declivity Boar
61	Lifting Angle Clips	114	Lifting Templates

III. *Teaching Hints*

A. Information to be presented:

1. An introduction to processes employed by shipfitters. Thi lesson *introduces* these processes; it does not attempt t develop detailed understanding or skill. Not all processe are included.

   Process or Subject - Page References listed above.

B. Suggested procedure:

1. Provide trainees with manual "Shipfitting Practice".

2. Request that trainees turn to pages of manual which the i structor designates. Indicate that you want the trainee form a mental picture of some common types of work, or pr cesses, used by the shipfitter.

3. Comment briefly concerning each process, calling attention photos or sketches in the manual.

   Do not go into detailed explanations of processes; indica only the general significance of the work represented.

4. State that in following lessons the trainee will be given opportunity to practice a number of these processes.

IV. *Assignment*

V. *Time* - 1 to 3 hours.

TRAINING FOR BEGINNING SHIPFITTERS

Instructor's Guide

I. *Topic No. 14* - How to Apply Dogs and Wedges.

II. *Tools and Equipment*

1. Hammer
2. Wedges (steel)
3. Dogs
4. Maul
5. Welding Equipment

Supplies

1/8" or 3/16" plates - approximately 1' x 3'. (5 sets - 10 plates)

III. *Reference* - "Shipfitting Practice", pp. 1-3, and 32-38.

IV. *Teaching Hints*

A. Safety

1. Protect eyes from welding arc.
2. Learn the proper use of maul.
3. Never use a substitute for wedges.

B. Information to be presented:

1. Where and when to use dogs and wedges.
2. Proper clearances in butts for welding.
3. Change of alignment due to tack welding.

C. Demonstration by the instructor:

1. Line up plates using dogs and wedges - (a tack welder is needed).
(Plates to be arranged similar to Figs. 48, 49, 50.)

NOTE: Call attention of trainees to clearance and change of alignment as work progresses.

D. Student practice:

1. Have trainees line and tack a butt by means of dogs and wedges.

(Trainees may work in groups of four.)

V. *Assignment*

Answer questions 1, 2, 6, 7, 8, - p. 5
1, 2, - p. 35
1, 4, - p. 38

VI. *Time* - 3 hours.

TRAINING FOR BEGINNING SHIPFITTERS

Instructor's Guide

I. *Topic No. 15* - How to Apply Yokes.

II. *Tools and Equipment*

1. Wedges
2. Maul
3. Welding equipment

Supplies

Yokes - Plate, channel, and angle
Flat bar and spacer
Flanged plate
Plate for deck, etc.

III. *Reference* - "Shipfitting Practice", pp. 3, 6, and 10.

IV. *Teaching Hints*

A. Safety

1. Proper welding of yoke, etc.

2. Proper maul handle length.

B. Information to be presented:

1. Proper use of wedges.

2. Proper distance between yokes, etc.

3. Proper size and spacing of tack welds.

C. Demonstration by the instructor:

1. Apply yokes as shown in Figs. 3 and 12.

D. Student practice:

1. Have trainees apply yokes. (Approximately four trainees may work together.)

V. *Assignment*

Answer questions 3, 4, 5, - p. 5

1, 2, - p.12

VI. *Time* - 3 hours.

I. *Topic No. 16* - How to Make and Apply Strongbacks.

II. *Tools and Equipment*

1. Welding equipment
2. Strawboard

Supplies

4 - 5/8" x 4" x 30" plates
4 - 7/8" x 4" bolts
12 - 7/8" washers

II. *Reference* - "Shipfitting Practice", pp. 87-92.

IV. *Teaching Hints*

A. Safety

1. Use a rope sling when lowering strongbacks into the ship.

B. Information to be presented:

1. Sizes of strongbacks to be used.
2. Where to place strongbacks.
3. Types of strongbacks.
4. Size of cutout for welding.

C. Demonstration by the instructor:

1. How to make strongbacks.
2. How to apply strongbacks.

D. Student practice:

1. Have trainees make up strongbacks. (Trainees will work in pairs.)

V. *Assignment*

Answer questions 1-4, p. 96.

VI. *Time* - 1 to 2 hours.

I. *Topic No. 17* - How to Use a Steamboat Ratchet.

II. *Tools and Equipment*

1. Steamboat ratchet (small)
2. Welding equipment

Supplies

12 - 5/16" x 4" bolts
Small pieces of batten
Model of deck section made of 1/8" steel
Pads with holes to accommodate size of ratchet or turnbuckle, as shown in Fig. 18

III. *Reference* - "Shipfitting Practice", pp. 12-14.

IV. *Teaching Hints*

A. Safety

1. Stand clear of bolts when tightening ratchet.
2. When operating ratchet be sure the pawl goes into the ratchet.
3. Use approved bolts.

B. Information to be presented:

1. Use of the ratchet.
2. How to hook up ratchet and bolts in single shear and in double shear.
3. Sizes of bolts to be used for different jobs.

C. Demonstration by the instructor:

1. How to hook up ratchet in way of stiffeners.
2. How to hook up ratchet for pulling deck sections togethe
3. How to hook up bolts in single and double shear.

D. Student practice:

1. Have trainees work individually to:

a. Hook up ratchet in way of stiffeners.
b. Hook up ratchet for pulling deck sections together.
c. Hook up bolts in single and double shear.

V. *Assignment*

Answer questions 1, 2, 3, - p. 14.

VI. *Time* - 3 hours

I. *Topic No. 18* - How to Use a Hydraulic Jack and Pump.

II. *Tools and Equipment*

1. Hydraulic Jack
2. Pump
3. Hose

III. *Reference* - "Shipfitting Practice", pp. 15-20.

IV. *Teaching Hints*

A. Safety

1. A definite support for the jack.

B. Information to be presented:

1. The care of a jack.

a. Fluids to be used in jack.

2. Common functional faults of a jack.
3. Use of the jack in pulling sections together.
4. Use of the jack in pushing sections apart.
5. Proper support of the jack.

C. Demonstration by the instructor:

1. How to connect a hydraulic jack to pump.
2. How to use a hydraulic jack and pump.
3. How to disassemble and repair a hydraulic jack.

D. Student practice:

1. Trainees operate pump and jack.

Group trainees, permitting each in turn to operate pump and jack.

V. *Assignment*

Answer questions 1, 2, 3, - p. 20.

VI. *Time* - 2 hours.

I. *Topic No. 19* - How to Lay Out Plates for Shearing, Planing, and Bevel Planing.

II. *Tools and Equipment*

1. Chalk line
2. Rule
3. Templates
4. Ball peen hammer

Supplies

Red template paper (in place of stock plate)
Tacks
Chalk
Soapstone

III. *Reference* - "Shipfitting Practice", pp. 154-156.

IV. *Teaching Hints*

A. Safety

1. Wear gloves when handling plates.
2. Be careful of sharp or barbed edges.

B. Information to be presented:

1. Layout of plate so that there is a minimum of shearing.
2. Layout of plate so that there is a minimum of burning.
3. Layout of plate to save material.
4. Checking plate to be sure it is square.
5. Allowing for planing when laying out a plate.
6. How to lay out for shearing, planing, and bevel planing

Explain and illustrate, using blackboard.

C. Student practice:

1. Lay out pieces using templates.
2. Lay out pieces by measurement.
3. From blueprints, lay out brackets and foundation plates on red template paper.

V. *Assignment*

Answer questions 1, 2, 3, - p. 156.

VI. *Time* - 6 hours.

I. *Topic No. 20* - How to Lay Out Angles for Punching and Shearing.

II. *Tools and Equipment* — *Supplies*

1.	Rules	5 pieces $\frac{1}{4}$" x 4" x 3" x 3'-0"
2.	5 center punches	angle bar (approximate size)
3.	5 ball peen hammers	
4.	5 sheet metal back markers	Soapstone
5.	Bending Lever	

III. *Reference* - "Shipfitting Practice", pp. 56-68.

IV. *Teaching Hints*

A. Safety

1. Shearing to be done only by power shear operator.
2. Use bending lever to turn angle bar.
3. Exercise care in using the bending lever.

B. Information to be presented:

1. Nomenclature of an angle.
2. Precautions to take when having angles planed.

C. Demonstration by the instructor:

1. How to use a bending lever to turn an angle bar.
2. How to read and use a gauge table (See Table IX, p. 58.)
3. How to lay out gauge- and end-landings.
4. How to backmark the shear line.

D. Student practice:

1. Have trainees work in groups of four and practice steps 2, 3, and 4 under "Demonstration".

V. *Assignment*

VI. *Time* - 1 to 3 hours.

I. *Topic No. 21* - Elementary Knowledge of the Lines of a Ship.

II. *Tools and Equipment*

1. Motion picture projector (16 mm. sound)
2. Sectional model of ship hull.

III. *References* - "Shipfitting Practice", pp. 97-106.
"Ship Erection", pp. 206-214.

IV. *Teaching Hints*

A. Information to be presented.

1. Emphasize base lines, water lines, buttocks, frame lines molded surface, profile, body plan, forward perpendicular, after perpendicular, length between perpendiculars, length over all, midship section, beam,and depth. See Figs. 121, 122, 123, and 124, of "Shipfitting Practice", pages 102-103.

Do not complicate this presentation.

B. Suggested procedure:

1. Discuss terms listed with group, using simple blackboard sketches.

2. Using a sectional model, illustrate basic lines of a ship; also such terms as beam, L.O.A.,L.B.P., etc.

3. Project a sound film on lines of a ship and basic shipbuilding practice. (Suitable films may be secured through your state department of public instruction, or the U. S. Office of Education, Federal Security Agency, Washington, D. C.)

It is probable that a local vocational school, junic or senior high school will arrange to project films. Also, the defense training division of your state de partment of public instruction may make arrangements for obtaining and projecting films.

V. *Assignment*

VI. *Time* - 2 to 3 hours.

TRAINING FOR BEGINNING SHIPFITTERS

Instructor's Guide

I. *Topic No. 22* - Declivity of Shipways.

II. *Tools and Equipment*

1. Level
2. Declivity board
3. $\frac{3}{4}$" x 6" x 5'-0" board
4. Several small blocks and wedges

II. *Reference* - "Shipfitting Practice", pp. 111-115.

IV. *Teaching Hints*

A. Information to be presented:

1. Meaning of declivity.
2. Why declivity is necessary.
3. Measurement of declivity.
4. How to use a declivity board.
5. Declivity applies only forward and aft.
6. All forward and aft measurements must be made with regard to declivity.

B. Demonstration by the instructor:

1. How the declivity board compensates for the slope of a shipway, permitting the use of a level. (See Fig. 131, "Shipfitting Practice".)

2. Why a declivity board is not used in leveling athwartship.

C. Student practice:

1. Have trainee level a mock up. Criticize for benefit of group.

2. Invite trainees to "try their hands" at leveling with a declivity board.

V. *Assignment*

VI. *Time* - 1 hour.

I. *Topic No. '23* - Safe Practices in the Shipyard.

II. *Tools and Equipment*

1. Safety helmet
2. Safety shoes
3. Goggles
4. Welding helmet

III. *Reference* - *"Ship Erection," Part II, pp. 7-13.

IV. *Teaching Hints*

A. Information to be presented:

1. Typical shipyard hazards.

a. Danger of falling.
b. Danger from falling objects.
c. Danger from inadequate personal protection.
d. Danger from combustibles.

2. Types of safety.

3. Safety rules for shipfitters.

V. *Assignment*

VI. *Time* - 1 to 2 hours.

*"Ship Erection", Bulletin 349, Pennsylvania Department of Public Instruction

PART II

Training for Advanced Shipfitters

PART II - TRAINING FOR ADVANCED SHIPFITTERS

Shipyards are continually looking for men who can do more responsible work. Men who can assume responsibility are urgently needed. Advanced training is one means of up-grading workmen.

Promising workers in less skilled, or single-skilled type shipyard occupations are sometimes re-assigned to shipfitting departments. In that these persons are employed and are somewhat familiar with shipyard practice, advanced instruction may be given. However, instructors teaching such groups, should determine the knowledge and skill which these persons have acquired, and present instruction listed under Part I, "Training for Beginning Shipfitters," either *before* the more comprehensive advanced instruction is given, or along with the advanced course. The important consideration is to be certain that necessary basic training is provided.

GENERAL COMMENTS CONCERNING ADVANCED INSTRUCTION FOR SHIPFITTERS

Prerequisites

In general, the statement of "objectives" indicates the ratings or classifications of persons who probably will be given advanced instruction. Because the specifications for these work classifications may vary considerably from yard to yard, the specific admission requirements should be determined in conference with responsible persons in the yard for which training is being given.

·Objectives of Advanced Training in Shipfitting

1. To up-grade shipfitter helpers, linermen, or third-class shipfitters so that they may be capable of performing the duties of second-class shipfitters.

2. To up-grade second-class shipfitters so that they may be capable of performing the duties of first-class shipfitters.

NOTE: Where conditions permit, it is desirable to consider each of the above objectives separately; that is, to organize classes for each group.

Advancement from third-class to second-class shipfitter, and from second-class to first-class shipfitter requires yard experience in addition to advanced instruction.

SUGGESTED OUTLINE OF INSTRUCTION
FOR
ADVANCED TRAINING IN SHIPFITTING

1. Location of Frame Lines.
2. How to Lift, Lay Out, and Regulate Liners.
3. How to Lift and Lay Out Angles.
4. How to Make Collars.
5. How to Use a Gauge Reduction Formula.
6. How to Lift, Lay Out, and Install Brackets.
7. How to Expand Lines of a Ship.
8. How to Use a Declivity Board and Level.
9. How to Lay Out and Assemble a Simple Foundation.
10. How to Fit Brackets in Way of Corrugated Bulkhead.
11. How to Plumb a Transverse Bulkhead.
12. How to "Horn in" a Section of a Ship.
13. How to Set and Scribe Foundations.
14. How to Set a Foundation after Launching.
15. How to Lift a Shell Frame Template from Ship.
16. How to Lift Shell Plates (Bilge).
17. How to Lay Out Shell Plates (Bilge).
18. How to Use Roll Sets.
19. How to Lay Out a Furnaced Plate (From Mold Loft Template).
20. How to Lay Out and Install Airports.
21. How to Assemble and Install Steel Castings - Stern Frame, Anchor Handling, Stem Castings.
22. How to Fit Engine Room Grating.
23. How to Fit Engine Room Floor Plates.
24. How to Lift and Install Deck Ladders.

25. How to Locate and Lay Out Manholes.

26. How to Locate, Lay Out, Lift, and Install Doors and Fittings.

27. How to Locate and Install Fittings for Rigging.

28. How to Locate and Set King Posts and Masts.

29. How to Locate and Install Mooring Equipment.

30. How to Locate and Install Ventilation Equipment.

31. How to Locate add Install Scuppers and Freeing Ports.

32. How to Locate and Install Pipe Protection.

33. How to Locate and Set Oil Tight Hatches.

34. How to Locate and Set Dry Cargo Hatches and Braces.

35. How to Locate and Install Equipment for Navigating Lights.

36. How to Develop a Cylinder.

37. How to Develop the Frustum of a Cone.

38. How to Lay Out a Camber Curve.

39. How to Develop a Cylinder with a Sloping Top.

40. How to Construct an Ellipse.

41. How to Develop a Right-Angle Intersection of Two Cylinders.

Tools to be Furnished by the Trainee for School Purposes

1. 2' folding rule
2. 6' folding rule
3. Pocket knife
4. 1½ lb. ball peen hammer
5. Combination square
6. 30 lb. cutty hunk chalk line
7. Center punch

Tools Needed by Trainee on Job

NOTE: These will be supplied by the school

1. Tools listed for school purposes
2. 2' square
3. 6" try-square
4. 50' steel tape
5. Level
6. 9" dividers
7. Trammel points
8. Steel straight edges

I. *Topic No. 1* - Location of Frame Lines.

II. *Tools and Equipment*

1. Shell drawing
2. Bulkhead drawing
3. Deck drawing
4. Tank top drawing

III. *Reference* - "Shipfitting Practice", pp. 107,123. (Figs. 126,141.)
pp. 120-124. (Figs. 137-142.)

IV. *Teaching Hints*

A. Information to be presented:

1. Define frame line.

2. When bulkhead drawing and shell drawing do not show the same side of a bulkhead as frame line, assume that the shell drawing is correct.

3. When laying out from frame lines on deck, always go below deck and check the frame line.

4. Frame lines are center punched on shell and decks.

5. How members are located on frame lines. See Fig. 142.

B. Illustration by the instructor:

1. Illustrate on a blackboard how to determine the frame line when a bracket connects the shell frame to the deck beam.

2. Illustrate how to determine on which side of the bulkhead the frame line is located.

3. Illustrate how to center punch frame lines.

4. Illustrate increased distances between frames as shell takes shape.

C. Student practice:

1. Trainees participate in class discussion on locating and marking frame lines.

V. *Assignment*

VI. *Time* - 1 hour

I. *Topic No. 2* - How to Lift, Lay Out, and Regulate Liners.

II. *Tools and Equipment*

1. Hammer
2. Center punch
3. Number of models as required:

   Tapered liner models - No. 1 - See page 46, Fig. 67
   Bowed liner models - No. 2
   Bilge section models - No. 3

Supplies

6" template wood

4" template wood

Strawboard

Pieces of flat bar and plate for laying out liners

III. *Reference* - "Shipfitting Practice," pp. 40-55.

IV. *Teaching Hints*

A. Safety

1. Be sure liners are firmly bolted or tack-welded before leaving the job.

B. Information to be presented:

1. Define lifting.
2. How ships are framed and plated.
3. How plates are fastened together.
4. Liner stock on hand including flat bar sizes.
5. Standard tapers.

C. Demonstration by the instructor:

1. How to lift various types of liners, using models 1, 2, and 3.
2. How to lay out various types of liners.

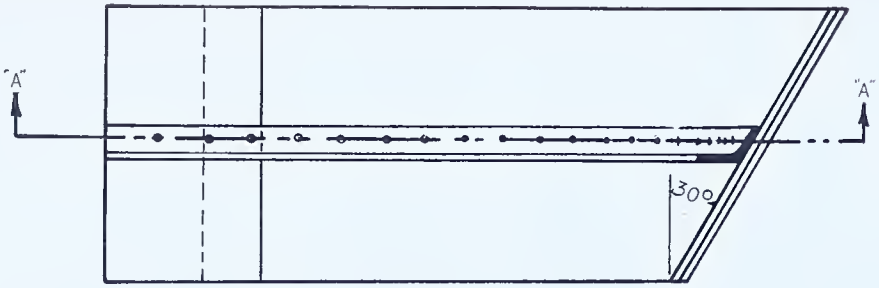
D. Student practice:

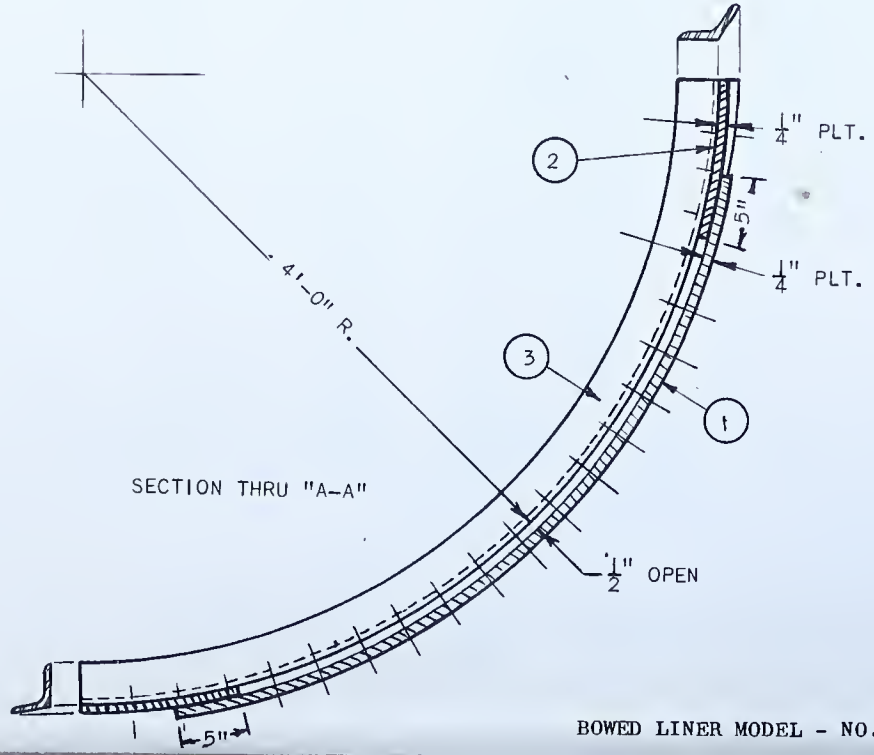
1. Have trainees lift and lay out tapered liners.
2. Have trainees lift and lay out bowed liners.
3. Have trainees lift and lay out rolled liners.
4. Have trainees mark templates correctly.

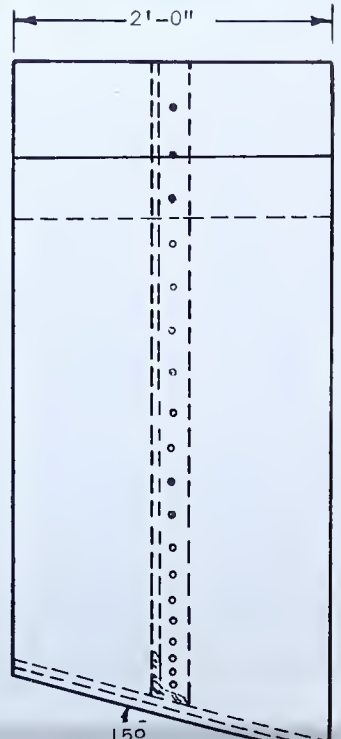
Trainees work in groups of four.

V. *Assignment*

VI. *Time* - 3 hours.

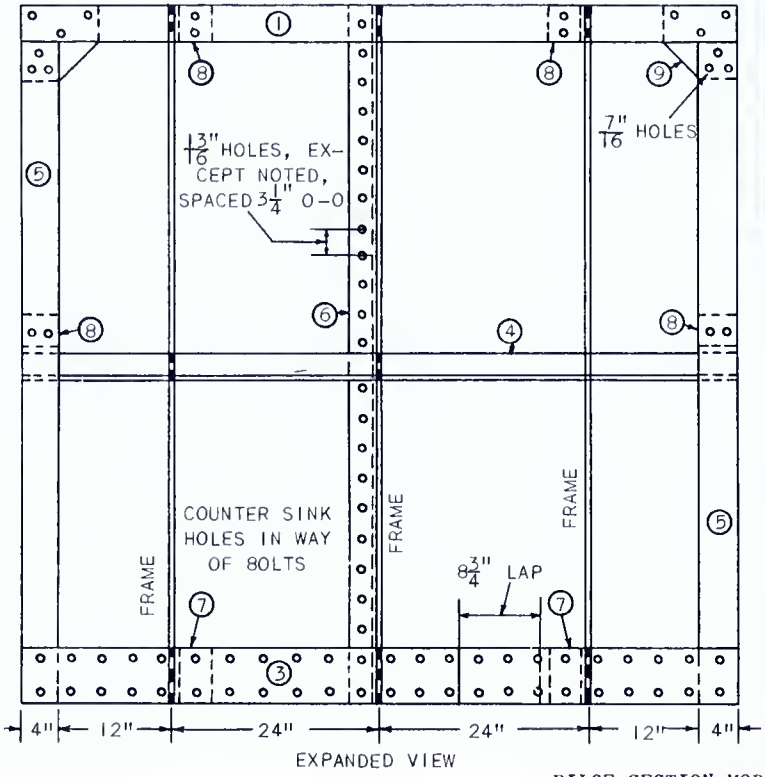




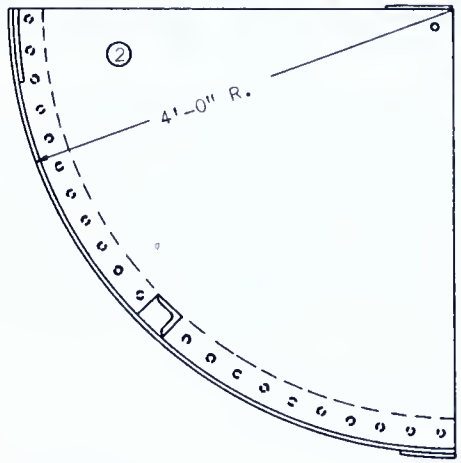


BOWED LINER MODEL - NO. 2

BILL OF MATERIAL		
①	1	F.B. 4" x 6'-8" x $\frac{1}{4}$"
②	3	PLTS 4'-0" x 4'-0" x $\frac{1}{4}$"
③	1	F.B. 5" x 7'-4$\frac{3}{4}$" x $\frac{1}{4}$"
④	1	ANGLE 3" x 3" x 6'-8"
⑤	2	F.B. 5" x 5'-8$\frac{3}{4}$" x $\frac{1}{4}$"
⑥	1	ANGLE 3" x 3" x 6'-5$\frac{3}{4}$"
⑦	2	CLIPS 3$\frac{1}{2}$" x 3$\frac{1}{2}$" x 5"
⑧	4	CLIPS 3$\frac{1}{2}$" x 3$\frac{1}{2}$" x 4"
⑨	4	GUSSETS 8" x 8" x $\frac{1}{4}$"
10		3/8" AND 3/4" BOLTS AS NECESSARY



EXPANDED VIEW



BILGE SECTION MODEL - NO. 3

I. *Topic No. 3* - How to Lift and Lay Out Angles.

II. *Tools and Equipment*

1. Bevel board
2. Ball peen hammers
3. Center punches
4. Angles - open bevel
5. Angles - closed bevel
6. Normal angles with one planed toe
7. Number of models as required:
   Angle clip models - No. 4
   Bilge section models - No. 3

Supplies

Strawboard
6" template wood
4" template wood

III. *Reference* - "Shipfitting Practice," pp. 56 to 68.

IV. *Teaching Hints*

A. Safety

1. Safe handling of angles in the shop.
2. Safe handling of angles on the ship.

B. Information to be presented:

1. Method of determining the thickness of an angle from a blueprint.
2. Use and definitions of gauge and landing.
3. Identification of beveled angles.
4. Why angles are planed.
5. Why rivet spacing varies.
6. Typical markings.

C. Demonstration by the instructor:

1. Different methods of lifting and laying out a normal angle.
2. Methods of lifting bevels.
3. How to apply proper gauge, using Table IX - p. 58.
4. Method of lifting and laying out a shaped angle.
5. Method of lifting and laying out a bowed angle.

D. Student practice:

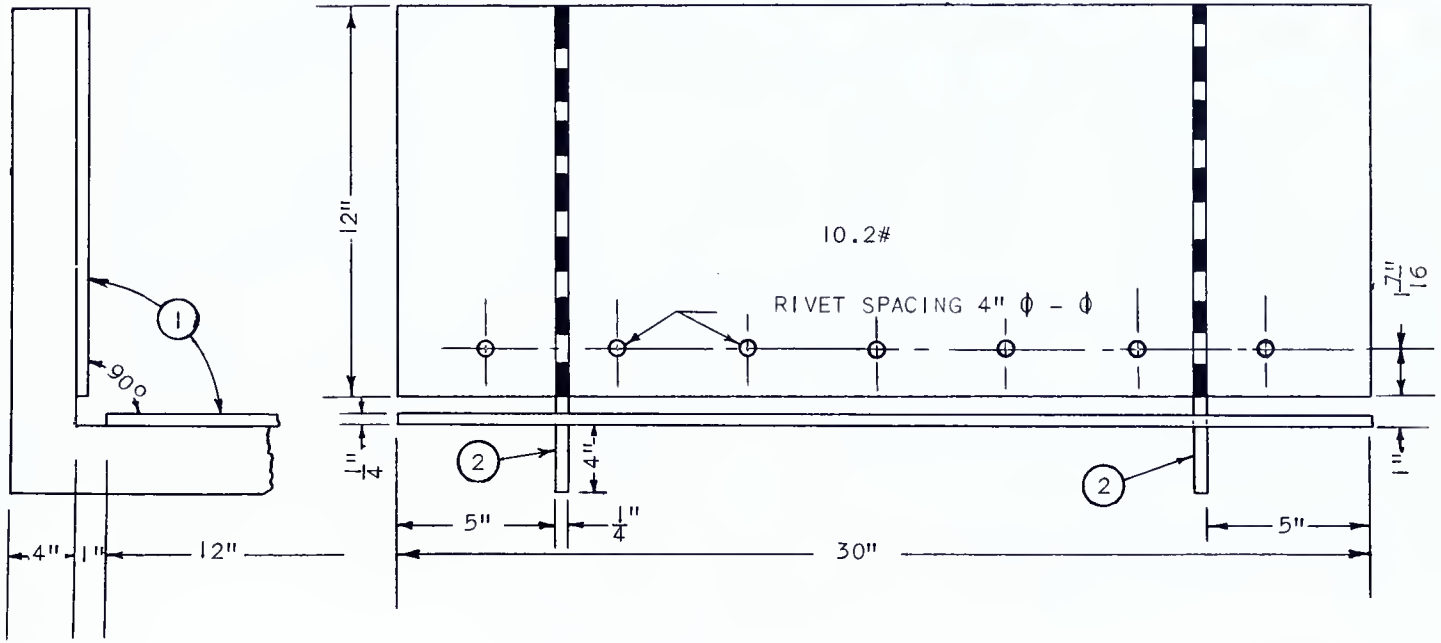
1. Have trainees work in groups of three doing the following jobs:

   a. Lift and lay out a normal angle.
   b. Lift bevels.
   c. Apply proper gauges.
   d. Lift and lay out a shaped angle.
   e. Lift and lay out a bowed angle.

V. *Assignment*

VI. *Time* - 6 hours.

BILL OF MATERIAL			
NO.	REQ.	SIZE	REMARKS
1	2	PLTS. 30" x 12" x $\frac{1}{4}$"	
2	2	BRKT. PLTS. 17" x 17" x $\frac{1}{4}$"	CUT TO FIT
NOTE – REMOVE SHARP EDGES FROM PLATES. TACK WELD PLATES TO BRACKETS			



ANGLE CLIP MODEL - NO. 4

I. *Topic No. 4* - How to Make Collars.

II. *Tools and Equipment*

1. Ball peen hammers
2. Center punches
3. 2' rules
4. Small pieces of angle
5. Small pieces of channel
6. Small pieces of bulb angle

Supplies

Strawboard

III. *Reference* - "Shipfitting Practice," pp. 80 to 83.

IV. *Teaching Hints*

A. Safety

1. Use gloves to pick up collars after they have been burned.

B. Information to be presented:

1. Use of collars.
2. Use of sheet metal templates for constructing collars.
3. Thickness of collar plate.
4. Minimum lap rule for welding.

C. Demonstration by the instructor:

1. How to construct a collar for angle.
2. How to construct a collar for channel.
3. How to construct a collar for bulb angles.
4. How to mark collars.

D. Student practice:

1. Have trainees construct a collar for angle.
2. Have trainees construct a collar for channel.
3. Have trainees construct a collar for bulb angles.
4. Have trainees mark collars.

Trainees work in groups of two.

V. *Assignment*

VI. *Time* - 2 hours.

Instructor's Guide

I. *Topic No. 5* - How to Use a Gauge Reduction Formula.

II. *Tools and Equipment*

1. Pocket knife
2. 2' rules

Supplies

Strawboard

III. *Reference* - "Shipfitting Practice," pp. 72 to 78.

IV. *Teaching Hints*

A. Information to be presented:

1. Formula to be used in flanging with other than standard 5/8" radius dies.

2. Simple formula used with standard dies.

B. Illustration by the instructor:

1. Illustrate gauge reduction in connection with making a flanged plate 8" x 4" x 3/8". Use a standard 5/8" radius die, and show a neutral surface of plate when flanged and calculated with dimensions given.

2. Illustrate the use of the formula on other than standard 5/8" radius dies.

C. Student practice:

1. Have trainees make templates for plates to be laid out flat. Have plates flanged and returned to the classroom. Plates should include both standard and special flanging dies. CONSIDER HOLES IN PLATES FOR THIS JOB.

Trainees work individually.

V. *Assignment*

VI. *Time* - 3 hours.

I. *Topic No. 6* - How to Lift, Lay Out, and Install Brackets.

II. *Tools and Equipment*

1. Pocket knife
2. Rule
3. Sketches or blueprints of four different types of brackets.
4. Model for lifting brackets - No. 5

Supplies

Strawboard

III. *Reference* - "Shipfitting Practice," pp. 69, 70, 71, 78, 79, 80.

IV. *Teaching Hints*

A. Safety

1. How to handle brackets safely.
2. Tack weld brackets in proper position.

B. Information to be presented:

1. Sizes of welded brackets.

NOTE: Refer to blueprint for proper size to be used.

2. Sizes of holes to be punched.
3. Need for brackets.
4. Proper weld lap (2T + 1").
5. Use of the gauge table.
6. Knowledge of the landing rule.

C. Demonstration by the instructor:

1. How to lift and lay out types of brackets.

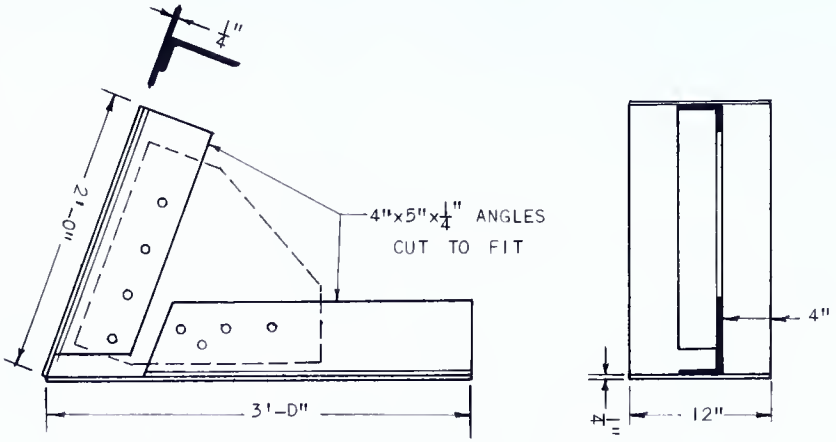
D. Student practice:

1. Supply each trainee with a sketch and have him make a template for the bracket as shown on the sketch.

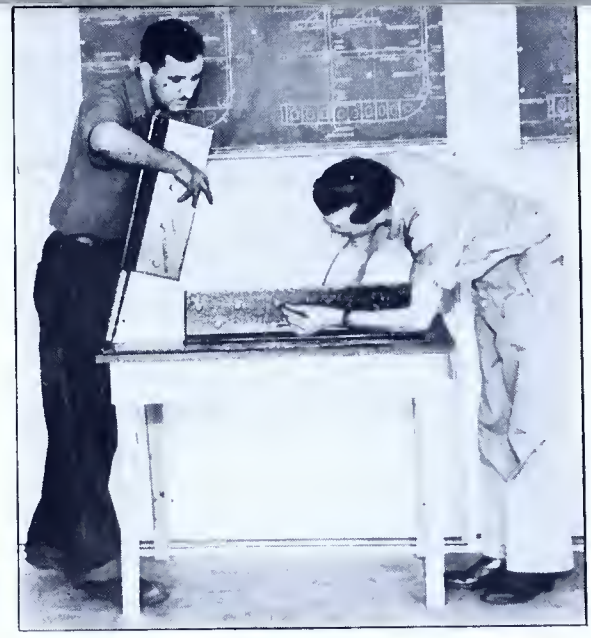
NOTE: Template must be complete with hole sizes, Hull No., Charge No., etc.

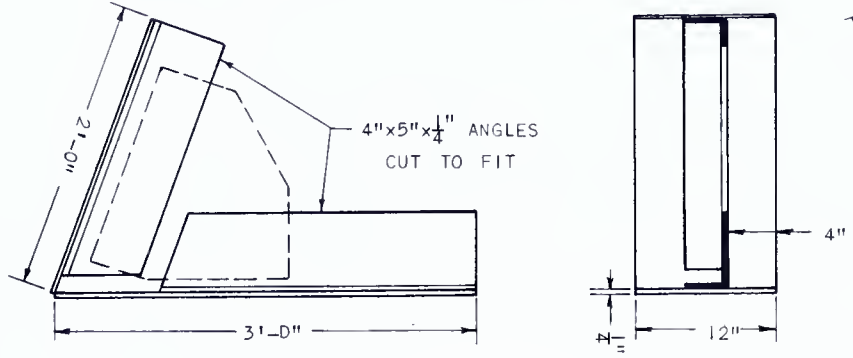
V. *Assignment*

VI. *Time* - 3 hours.

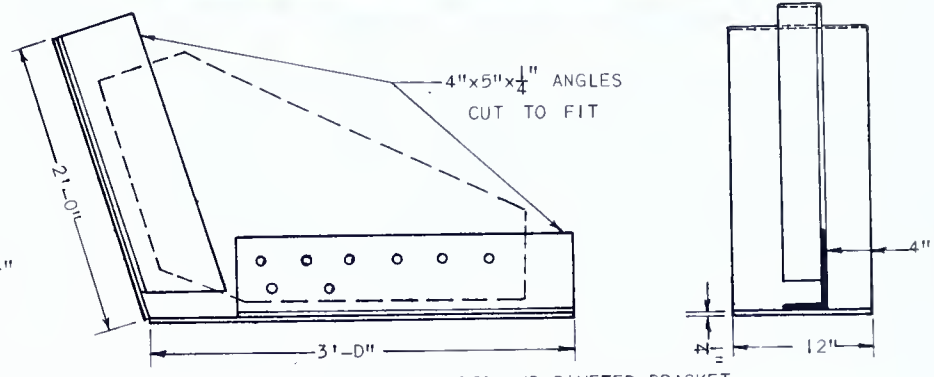


5–A – MODEL FOR RIVETED BRACKET





5–B – MODEL FOR LAP WELDED BRACKET



5–C – MODEL FOR WELDED AND RIVETED BRACKET

BRACKET MODEL – NO. 5

TRAINING FOR ADVANCED SHIPFITTERS

Instructor's Guide

I. *Topic No. 7* - How to Expand Lines of a Ship.

II. *Tools and Equipment*

1. Rules
2. Straight Edges
3. Chalk Lines
4. Fairing Battens
5. Dividers

Supplies

Chalk

III. *Reference* - "Shipfitting Practice," pp. 97 to 106.

IV. *Teaching Hints*

A. Information to be presented:

1. Definitions of lines of a ship.

2. How to use ship's lines as working lines.

3. How to use offsets.

4. How to fair-in lines on various plans.

B. Demonstration by the instructor:

1. Illustrate on blackboard how to develop Half-breadth Plan, Water Lines Plan, and Body Plan.

C. Student Practice:

1. Have trainees work in groups of three, fairing-in lines of a Body Plan, Water Lines Plan, and Half-breadth Plan from a table of offsets.

V. *Assignment*

VI. *Time* - 12 to 15 hours.

Instructor's Guide

I. *Topic No. 8* - How to Use a Declivity Board and Level.

II. *Tools and Equipment*

1. Declivity board
2. Level
3. 2' rule
4. Pocket knife
5. Declivity models - No. 6

Supplies

6" template wood

II. *Reference* - "Shipfitting Practice," pp. 111-114.

IV. *Teaching Hints*

A. Information to be presented:

1. Definition of declivity.

a. Give examples of declivity and tell why a ship is built on a shipway having declivity.

2. Placing of level and declivity board.

3. Use of declivity board and level in relation to sheer and camber.

B. Demonstration by the instructor:

1. Make a sketch on blackboard showing ground, keel blocks, base line, bulkheads, decks, etc. Illustrate declivity on each.

2. Check the declivity of the model, using a declivity board and level.

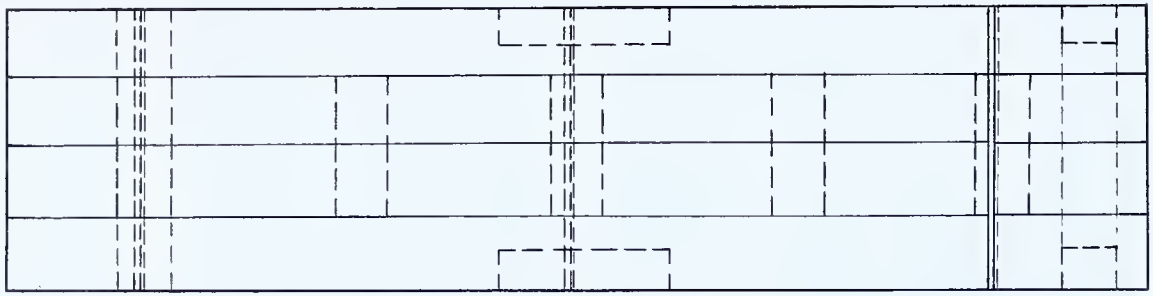
C. Student practice:

1. Have trainees work individually and check declivity of model at different degrees of declivity.

2. Have trainees make a declivity board of 30" and 36" lengths using template wood, knife, and rule.

V. *Assignment*

VI. *Time* - 2 to 3 hours.

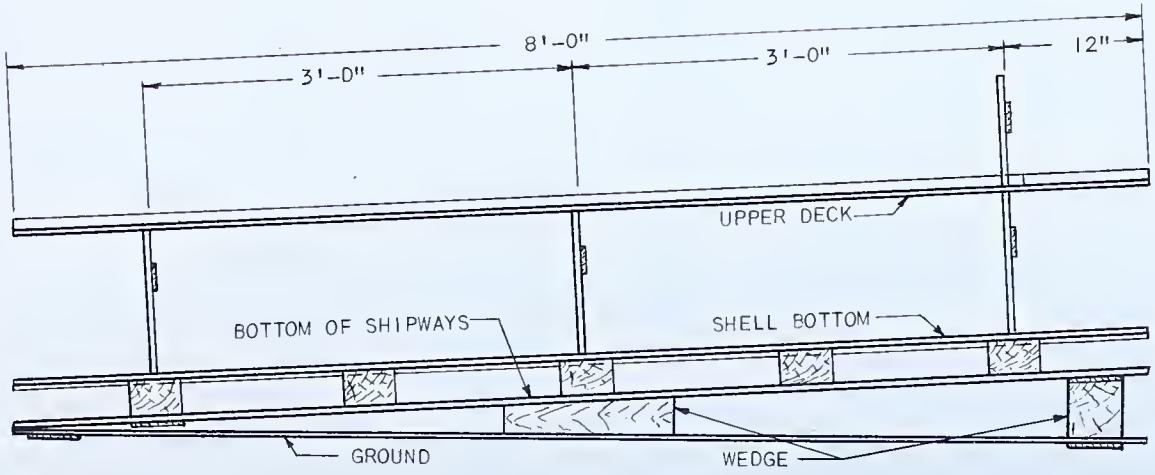


PLAN OF UPPER DECK

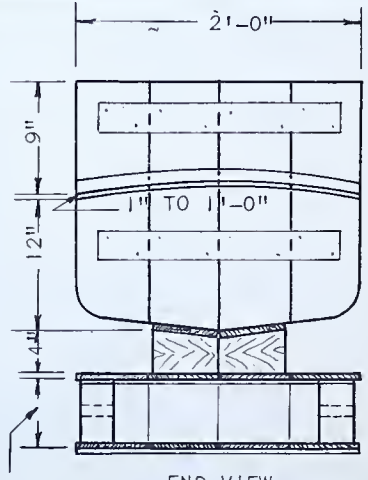
GROUND, SHIPWAYS, AND SHELL BOTTOM SIMILAR

NOTE:

1. USE ½" x 6" WHITE PINE
2. USE NAILS THROUGHOUT



SIDE ELEVATION



HEIGHT DETERMINED BY DECLIVITY OF SHIPWAY

END VIEW

DECLIVITY MODEL - NO. 6

Instructor's Guide

I. *Topic No. 9* - How to Lay Out and Assemble a Simple Foundation.

II. *Tools and Equipment*

1. 2' square
2. Steel straight edge
3. Blueprints of simple foundation
4. 2' rule
5. Pocket knife
6. 6' rule

Supplies

4" template wood
Strawboard

II. *Reference* - "Shipfitting Practice," pp. 147-151.

IV. *Teaching Hints*

A. Information to be presented:

1. Definition and uses of foundations.
2. Why foundations are prefabricated.
3. Why stock is left on foundations.
4. How to determine location and height of foundation.

B. Demonstration by the instructor:

1. Make a sketch on the blackboard, showing different views of the foundation.
2. Illustrate how a trainee is to work from a blueprint and lay out a foundation on strawboard.
3. How to assemble a foundation, using set marks.

C. Student practice:

1. Trainees work in groups of three, using blueprint, and laying out each piece of foundation on strawboard (set marks to be placed on each piece.)
2. Trainee should cut pieces and assemble them with glue. (Distances from center line and frame lines should be noted on template.)
3. Trainee should mark foundation correctly.

NOTE: These foundations may be used as models when teaching lesson #13 - "How to Set and Scribe Foundations."

V. *Assignment*

VI. *Time* - 6 hours.

TRAINING FOR ADVANCED SHIPFITTERS

Instructor's Guide

I. *Topic No. 10* - How to Fit Brackets in Way of Corrugated Bulkhead.

II. *Tools and Equipment* — *Supplies*

1. 2' rule — Strawboard
2. Penknife
3. Lifting jig or portable template
4. Model of a corrugated bulkhead - No. 7

III. *Reference* - "Shipfitting Practice," p. 109.

IV. *Teaching Hints*

A. Information to be presented:

1. Frame lines on corrugated bulkheads.

B. Demonstration by the instructor:

1. Scribe along the model of the corrugated bulkhead on the strawboard template of the bracket. Show horizontal measurement at all times.

2. Demonstrate how to use a lifting jig to fit bracket.

C. Student practice:

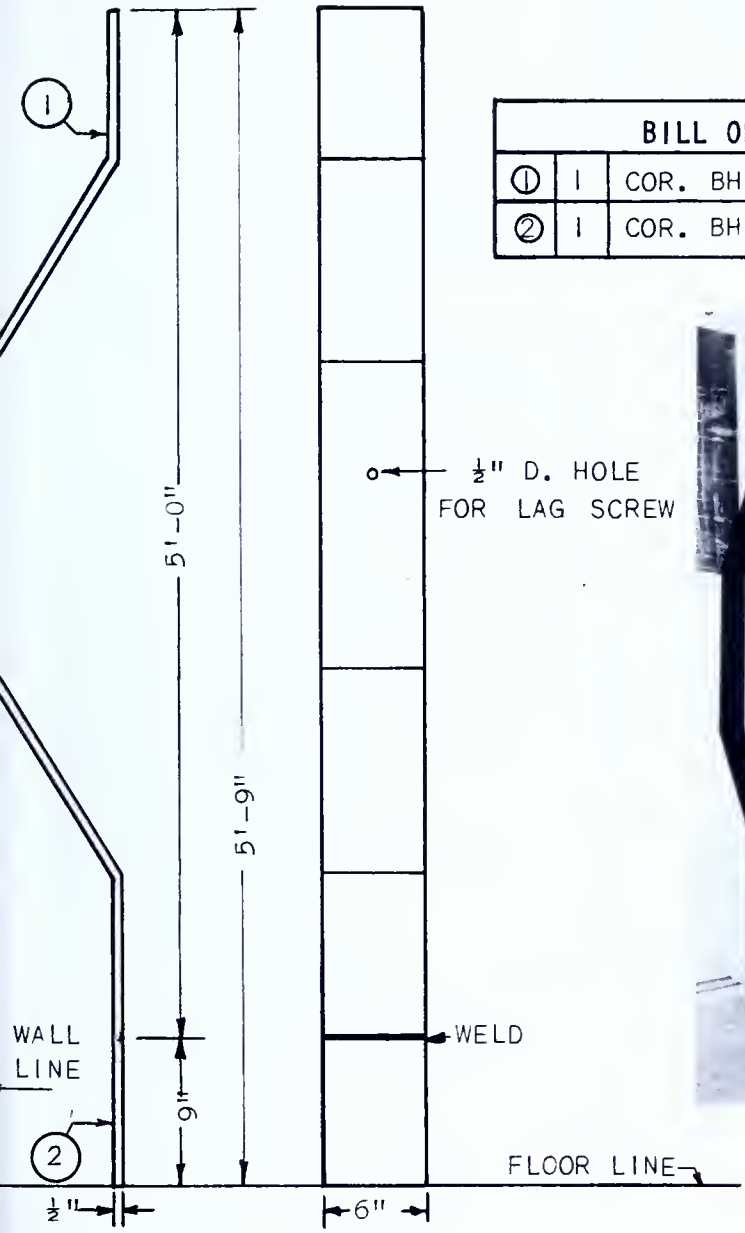
1. Scribe along the models of the corrugated bulkhead on the strawboard template of brackets.

NOTE: Use lifting jig to lay out bracket.

2. Cut template with penknife and check fit.

V. *Assignment*

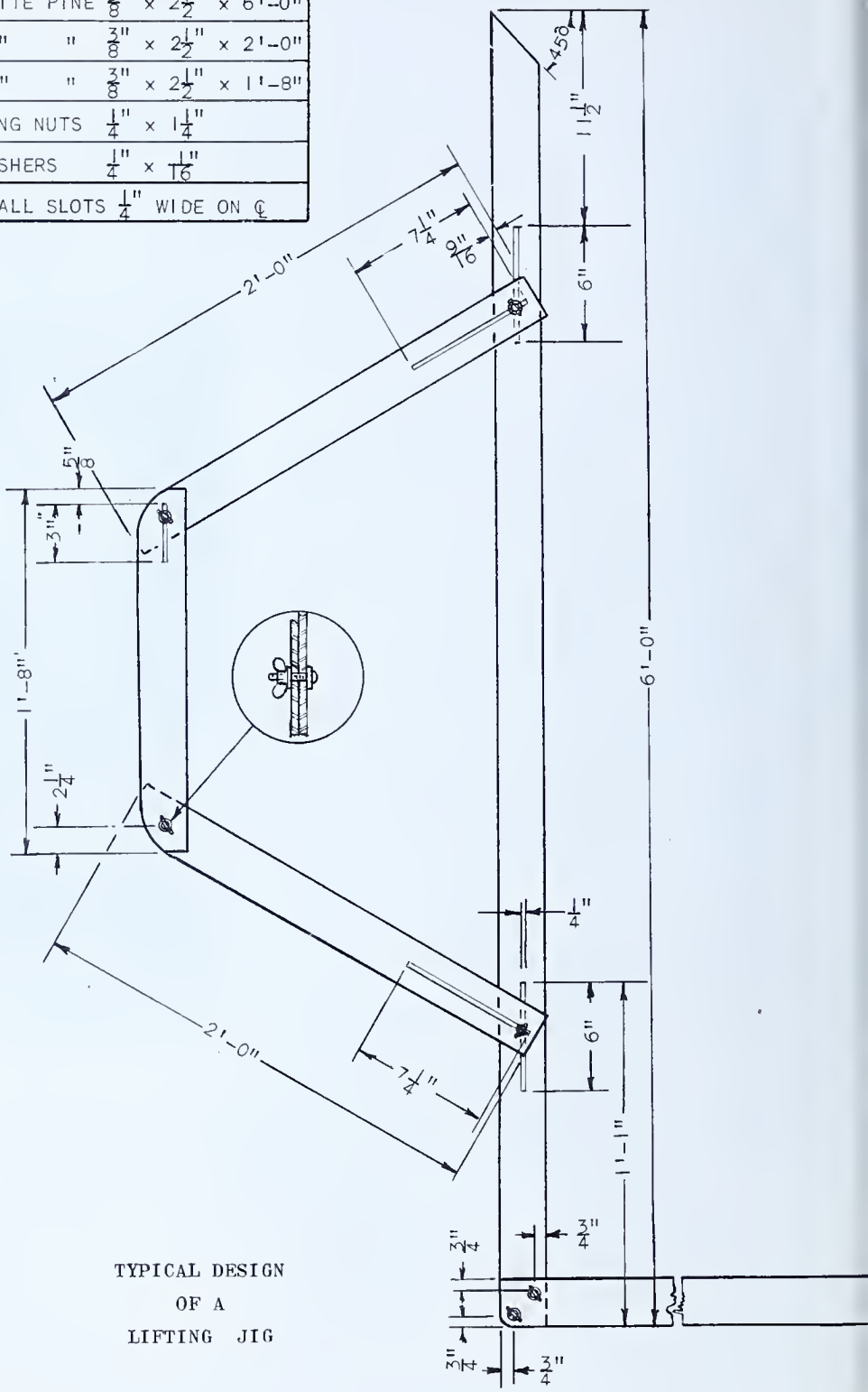
VI. *Time* - 3 hours.



BILL OF MATERIAL		
①	1	COR. BHD. 5'-0" x 6" x ½"
②	1	COR. BHD. 9" x 6" x ½"

CORRUGATED BULKHEAD MODEL - NO. 7

BILL OF MATERIAL		
①	1	WHITE PINE $\frac{3}{8}$" × $2\frac{1}{2}$" × 6'-0"
②	2	" " $\frac{3}{8}$" × $2\frac{1}{2}$" × 2'-0"
③	1	" " $\frac{3}{8}$" × $2\frac{1}{2}$" × 1'-8"
④	6	WING NUTS $\frac{1}{4}$" × $1\frac{1}{4}$"
⑤	12	WASHERS $\frac{1}{4}$" × $\frac{1}{16}$"
NOTE – ALL SLOTS $\frac{1}{4}$" WIDE ON ℄		



TYPICAL DESIGN
OF A
LIFTING JIG

I. *Topic No. 11* - How to Plumb a Transverse Bulkhead.

II. *Tools and Equipment*

1. Plumb bob and line
2. Declivity models - No. 6
3. 2' rule

III. *Reference* - "Shipfitting Practice," pp. 114-115.

IV. *Teaching Hints*

A. Safety

1. Shores and stays should be of sufficient size and in the proper position to hold the load safely.

B. Information to be presented:

1. Where to hang plumb bob.
2. How to find correct declivity.
3. How to check port or starboard lean.
4. How to secure and fasten a bulkhead.
5. Where to place plumb bob in case of obstructions.
6. How to protect plumb bob from wind.
7. Use of set marks.

C. Demonstration by the instructor:

1. Demonstrate where to hang plumb bob.
2. Demonstrate how to find correct declivity.
3. Demonstrate how to check port or starboard lean.
4. Demonstrate how to secure and fasten a bulkhead.
5. Demonstrate where to place plumb bob in case of obstructions.
6. Demonstrate how to protect plumb bob from wind.
7. Demonstrate use of set marks.

D. Student practice:

1. Trainees should take part in class discussion.
2. PROBLEMS: Have trainees find the declivity of bulkheads having various heights.

V. *Assignment*

VI. *Time* - 3 to 6 hours.

Instructor's Guide

I. *Topic No. 12* - How to "Horn in" a Section of a Ship.

II. *Tools and Equipment*

1. 50' tape
2. Chalk line
3. Dividers
4. Wire reel

Supplies

Chalk

III. *Reference* - "Shipfitting Practice," pp. 115-117.

IV. *Teaching Hints*

A. Safety

1. See that pieces of paper are attached to steel wire so that it can easily be seen.

2. Be careful not to tighten the wire to the breaking point.

B. Teacher preparation:

1. Draw a plan view of deck sections on the floor of the classroom, showing the center line out of square and the frame lines in the proper position.

C. Information to be presented:

1. Use of wire reel.

2. Three methods of squaring a line.

D. Illustration by the instructor:

1. Draw typical sections of deck or inner bottom on board and explain "Horning in".

2. Explain how to change lines so that they are square, or how to move sections until they are properly aligned.

E. Student practice:

1. Have trainees practice squaring lines, using methods illustrated in reference.

NOTE: Trainees work individually.

2. Have trainees check frame lines in relation to center line to determine if they are square.

NOTE: Trainees should work in groups of two.

V. *Assignment*

VI. *Time* - 1 to 2 hours.

I. *Topic No. 13* - How to Set and Scribe Foundations.

II. *Tools and Equipment*

1. 2 ft. rule
2. 6 ft. rule
3. Number of models as required:
   a. Model representing foundation fitting against a sloping member. See Fig. 167, p. 153 - No. 8
   b. Model representing foundation fitting against a bulkhead - No. 9
   c. Models representing foundation fitting on deck. See Fig. 163, p. 150 - No.10
4. Steel spacer
5. Level
6. Declivity board
7. 2' square

III. *Reference* - "Shipfitting Practice," pp. 147-156.

IV. *Teaching Hints*

A. Safety

1. Be sure there is enough weld on the lifting pad for handling foundations.
2. Be sure that foundations are securely tacked before leaving the job.

B. Information to be presented:

1. Leveling a foundation.
   a. Use of stiffeners.
   b. Use of declivity board and level on foundations sitting obliquely to center line of ship.
2. How to find the correct position for setting the foundation.
3. How to determine the height of the foundation above the tank top.
4. How to use frame lines, center lines, base lines, buttock lines, and water lines to establish the location of foundations.

C. Demonstration by the instructor:

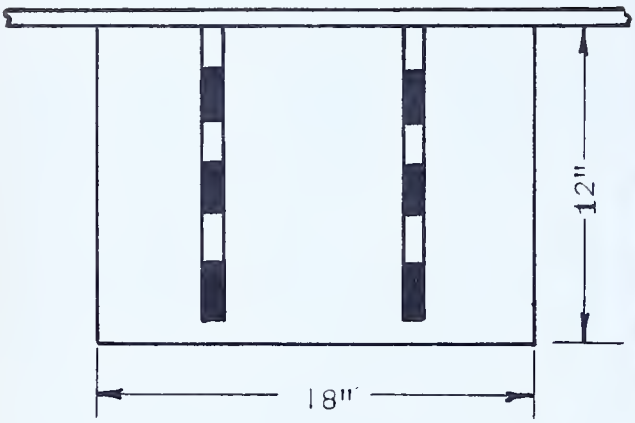
1. How to set a foundation to a bulkhead.
2. How to scribe and set foundation to a sloping member.

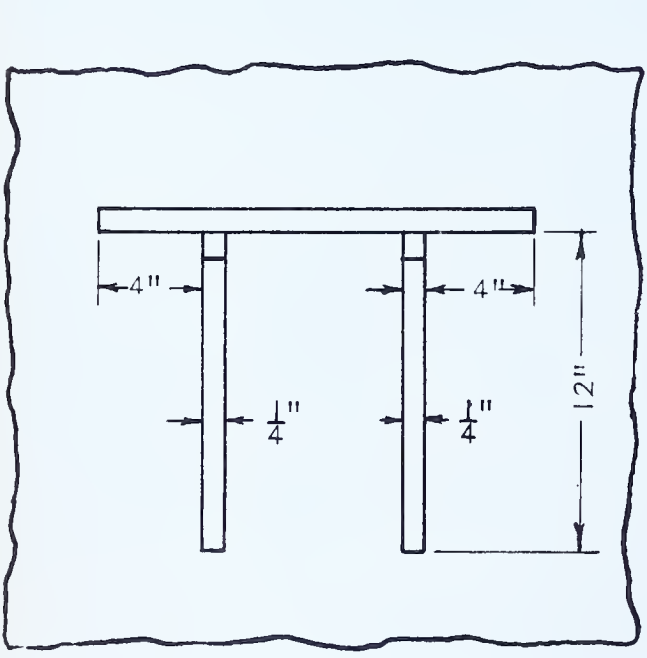
D. Student practice:

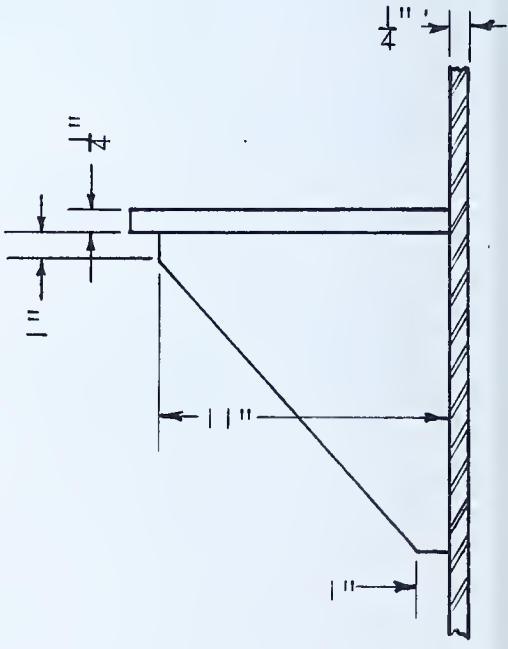
1. Set and locate a foundation using Model No. 8.
2. Set and locate a foundation using Model No. 9.
3. Set and locate a foundation using Model No. 10.

V. *Assignment*

VI. *Time* - 3 to 6 hours.







FOUNDATION MODEL - NO. 9

I. *Topic No. 14* - How to Set a Foundation after Launching.

II. *Tools and Equipment*

1. 2 ft. steel square
2. Number of models as required:
   a. Model representing foundations fitting against a sloping member - No. 8
   b. 3 models representing foundations fitting against a bulkhead - No. 9
   c. 3 models representing foundations fitting on deck - No. 10
3. 50' steel tape

Supplies

Strawboard to make bracket for spare tailshaft foundation.

II. *Reference* - "Shipfitting Practice," pp. 153-155.

IV. *Teaching Hints*

A. Safety

1. See "How to Set Foundations" - Lesson 13.

B. Information to be presented:

1. How to make a large square.

2. How to set a foundation on a deck without sheer or camber by measuring.

3. How to set a foundation on a deck having sheer and camber by means of:

   a. Targets and measuring.
   b. Large square.

4. How to set a foundation on shell by means of targets and measuring. See Fig. 168 - "Shipfitting Practice."

C. Demonstration by the instructor:

1. Illustrate how to make a large try-square. Draw sketch on blackboard.

2. Illustrate how to set a foundation on a deck without sheer or camber by measuring. Sketch on blackboard.

3. Demonstrate, using models, how to set a foundation on a deck having sheer and camber by means of:

   a. Targets and measuring.
   b. Large square.

D. Student practice:

1. Have trainees work in groups of three, interchanging positions so that each trainee works on each job:

   Group 1 - Set a foundation on a deck without sheer or camber by measuring.

   Group 2 - Set a foundation on a deck having sheer and camber by means of:

      a. Targets and measuring.
      b. Large square.

   Group 3 - Set a foundation on shell by use of targets and measuring.

V. *Assignment*

VI. *Time* - 9 to 12 hours.

I. *Topic No. 15* - How to Lift a Shell Frame Template from Ship.

II. *Tools and Equipment*

1. Model of bilge section - No. 3
2. Pocket knife
3. 2' rules
4. 6' rules
5. Ball peen hammers
6. "C" clamps (small)

Supplies

6" template wood
Tacks

II. *Reference* - "Shipfitting Practice," pp. 125-128. Page 58, Fig. 9.

IV. *Teaching Hints*

A. Information to be presented:

1. Reason for lifting frames.
2. Methods of lifting, depending on conditions.
3. Method of lifting shaped templates.
4. Correct bracing of template.

B. Demonstration by the instructor:

1. Lift a shaped template from model No. 3.

C. Student practice:

1. Lift shaped templates from the model.
2. Lift female template from the model.
3. Make a male template.
4. Lift a bolted template from the model.
5. Lift template according to Fig. 145 in "Shipfitting Practice."

Trainees work in groups of three.

V. *Assignment*

VI. *Time* - 6 hours.

I. *Topic No. 16* - How to Lift Shell Plates (Bilge).

II. *Tools and Equipment*

1. Hammers (ball peen)
2. Small "C" clamps
3. Spring clamps
4. Marking pencils (red and blue)
5. Models of bilge section - No. 3

Supplies

4" batten
6" batten
Tacks
Square battens for girthing strips

III. *Reference* - "Shipfitting Practice," pp. 129-137.

IV. *Teaching Hints*

A. Safety

1. Make certain that staging is constructed safely.

B. Information to be presented:

1. Methods of making templates (ship or shop).
2. How to tack battens.
3. How to fasten template.
4. How to mark template (holes, butts, identification).
5. How to test template (girthing).
6. Precaution to take in handling and storing template.

C. Demonstration by the instructor:

1. Make and lift template on model.
2. Make a template from a sketch and lift a plate from the model.
3. Test template by girthing the model.

D. Student practice:

1. Have trainees work in groups of four, staggering jobs so that each group will make and lift a template on the model and make a template from a sketch.
2. Test the templates by girthing.

V. *Assignment*

VI. *Time* - 6 hours.

I. *Topic No. 17* - How to Lay Out Shell Plates (Bilge).

II. *Tools and Equipment*

1. Ball peen hammers
2. Wood punches
3. Center punches
4. Backmarkers
5. Bill of Material
6. Marking brush

Supplies

Chalk
Soapstone
Template paper
Marking paint

II. *Reference* - "Shipfitting Practice," pp. 136-138.

IV. *Teaching Hints*

A. Safety

1. Punches are to be ground free of mushrooms.

B. Information to be presented:

1. How and when to order proper stock.
2. How to apply template to plate.
3. How to duplicate markings (holes, butts, etc.)
4. How to check a template using girth sticks.
5. How to paint markings on plate (Fig. 156.)

C. Demonstration by the instructor:

1. Illustrate system of ordering proper stock for each plate.
2. How to apply template to template paper (representing steel plate).

D. Student practice:

1. Trainees should be called upon to work in front of the class two at a time:
   a. Applying template.
   b. Wood punching.
   c. Checking girth.
   d. Painting plate.

V. *Assignment*

VI. *Time* - 3 hours.

I. *Topic No. 18* - Use of Roll Sets.

II. *Tools and Equipment*

1. Roll sets for one plate.
2. Chalk line.

III. *Reference* - "Shipfitting Practice," pp. 135, 136, 141.

IV. *Teaching Hints*

A. Information to be presented:

1. How roll sets are made in the mold loft.
2. How to apply roll sets to the plate before rolling.
3. How to set, back-set, and twist a plate in the rolls.
4. How to check a plate after it is rolled.
5. How to lift roll sets from boat when necessary.

B. Demonstration by the instructor:

1. Illustrate how sets are made from the body plan.
2. Draw an outline of a plate on the floor and demonstrate how to apply sets before rolling.
3. Illustrate how to put plate in rolls for set, back-set, and twist.
4. Illustrate how to apply roll sets to the plate after rolling to check plate shape.

C. Student practice:

NOTE: Owing to the fact that this job will be handled by only a few men, a small amount of student practice should suffice.

1. Apply sets before plate is rolled, using outline of plate drawn on floor.
2. Student participation in class discussion.

V. *Assignment*

VI. *Time* - 3 to 6 hours.

I. *Topic No. 19* - How to Lay Out a Furnaced Plate (From Mold Loft Template).

NOTE: A lesson on lifting furnaced plates may be given. This will be given at the instructor's discretion.

II. *Tools and Equipment*

1. Ball peen hammers
2. Tit punches
3. Backmarkers
4. A small template of a furnaced plate
5. "C" clamps

III. *Reference* - "Shipfitting Practice," pp. 140-141.

IV. *Teaching Hints*

A. Safety

1. Wear goggles when center punching on furnaced plates.
2. Be careful when handling furnaced plates.

B. Information to be presented:

1. Where to apply the template on the plate.
2. How to duplicate a template on a plate.
3. When to burn by hand and when to burn using a portable burning machine.
4. When to leave stock on the plate.

C. Demonstration by the instructor:

1. How to apply sets to check plate.
2. How to back mark plate.
3. How to apply template.
4. How to duplicate template on plate.
5. How to paint plate.

D. Student practice:

1. Trainees assist instructor and enter into discussion while instructor is demonstrating.

V. *Assignment*

VI. *Time* - 6 hours.

I. *Topic No. 20* - How to Lay Out and Install Airports.

II. *Tools and Equipment*

1. Stenciled airport.
2. 5/8" spud wrench
3. "T" screw driver
4. Fixed light
5. Blueprint and bill of material for use in laying out holes
6. Airport model - No. 11
7. Circle torch

III. *Reference* - "Shipfitting Practice," pp. 169-171.

IV. *Teaching Hints*

A. Safety

1. Take all necessary precautions when burning the hole for the installation of the airport.

B. Information to be presented:

1. Preparation of airport for installation.
2. How to locate the holes under various conditions.
3. How to check fairness in way of hole.
4. How to set and check the circle torch.
5. How to stencil the parts of the airport.
6. How to drill, make water-tight, protect, and tighten bolts.
7. How to lay out hole where shell and bulkhead have radius.
8. How to keep hinge lug level.
9. How to install a hanger support.

C. Demonstration by the instructor:

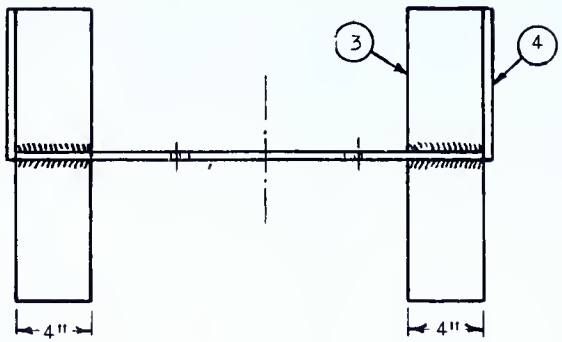
1. Demonstrate how to set and check the circle torch.
2. Demonstrate how to stencil the parts of the airport.
3. Demonstrate how to make an airport water-tight.
4. Demonstrate how to tighten bolts.
5. Illustrate how to lay out hole where shell and bulkhead have radius.

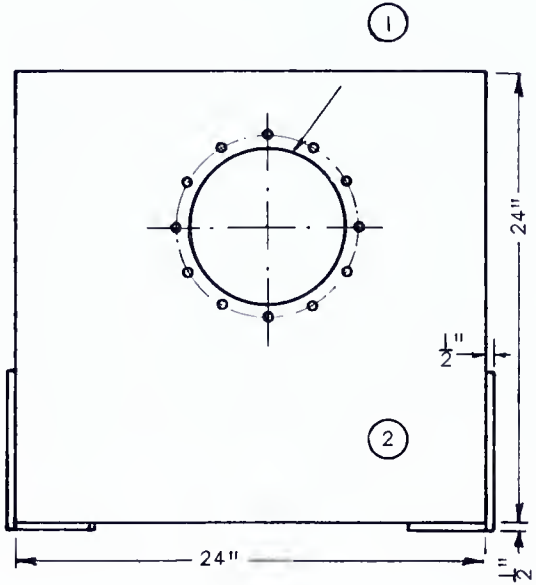
D. Student practice:

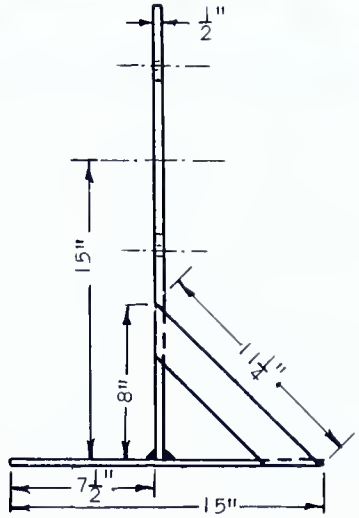
1. Have trainees set and check a circle torch.
2. Install and tighten airport frame.
3. Install glass and "dead light".
4. Have trainees lay out hole in bulkhead for airport.

V. *Assignment*

VI. *Time* - 3 to 6 hours.







AIR PORT MODEL - NO. 11

I. *Topic No. 21* - How to Assemble and Install Steel Castings: Stern Frame, Anchor Handling, Stem Castings.

II. *Tools and Equipment*

1. Several small castings, such as cleats, pad eyes.
2. Several small forgings.
3. Blueprints of Hawse Pipes, Stern Castings, and Mooring Equipment.
4. Procedure sheets to assemble steel castings.

III. *Reference* - "Shipfitting Practice," pp. 145-147.

IV. *Teaching Hints*

A. Safety

1. Be sure lifting pads are securely welded and in the proper position for lifting.

B. Information to be presented:

1. Welding on castings.
2. Heat Numbers.
3. Pattern Numbers.
4. Proper Location of Lifting Pads.
5. Proper Bracing.
6. Casting Shrinkage.

C. Illustration by the instructor:

1. Sketch on blackboard or use prints of stern casting section.

NOTE: Explain the procedure for assembling and preparing stern castings. Include the preparation of the stern castings for erection.

2. Sketch on blackboard or use prints of hawse pipe sections.

NOTE: Explain the procedure for installing hawse pipes.

D. Student practice:

1. Student participation in class discussion on steps in procedure of assembling and installing steel castings.

V. *Assignment*

VI. *Time* - 1 to 3 hours.

I. *Topic No. 22* - How to Fit Engine Room Grating.

II. *Tools and Equipment*

1. 6" square
2. Blueprints of engine room grating
3. Sketches from ship of engine room grating
4. 2' rules
5. Chalk line
6. Dividers
7. Straight edge
8. Pocket knife
9. Hammers

Supplies

4" batten
Chalk
Tacks

III. *Reference* - "Shipfitting Practice," pp. 157-161.

IV. *Teaching Hints*

A. Safety

1. Always be sure grating is properly secured before leaving job.

B. Information to be presented:

1. How to fasten grating.
2. How to check blueprint with actual condition on ship.
3. How grating is constructed.
4. How to allow for expansion.
5. How to support grating.
6. How to make templates for grating.

C. Demonstration by the instructor:

1. Illustrate how it will be necessary to alter a blueprint if measurements taken from the ship show different dimensions from those specified on the print.

2. Using altered print or sketch, make and mark a template for one section of engine room grating.

D. Student practice:

1. Have trainees make templates from sketches of different sections.

NOTE: Trainees work in groups of three.

V. *Assignment*

VI. *Time* - 3 hours.

I. *Topic No. 23* - How to Fit Engine Room Floor Plates.

II. *Tools and Equipment*

1. 6" square
2. Blueprints of engine room floor plates
3. Sketches from ship of engine room floor plates
4. 2' rules
5. Chalk line
6. Dividers
7. Straight edge
8. Pocket knife
9. Hammers

Supplies

4" batten
Chalk
Tacks

III. *Reference* - "Shipfitting Practice," pp. 161-164.

IV. *Teaching Hints*

A. Safety

1. Always be sure that floor plates are supported safely before leaving job.

B. Information to be presented:

1. Sizes and construction of floor plates.
2. How to support floor plates. Figs. 177, 178.
3. How to lift from ship by sketch and lay out floor plate supports.

C. Demonstration by the instructor:

1. Using procedure outlined on pages 162 and 163, show on the blackboard how to duplicate a section of the floor according to the sketch.
2. Demonstrate how to mark templates.

D. Student practice:

1. Trainees working in groups of three will reproduce different sections of floor plates from sketch to the floor.
2. Trainees will mark and cut templates.

V. *Assignment*

VI. *Time* - 3 to 6 hours.

I. *Topic No. 24* - How to Lift and Install Deck Ladders.

II. *Tools and Equipment*

1. Model No. 12 for lifting inclined ladder
2. 6" try-square
3. Pocket knife
4. 2' rules
5. 6' rules

Supplies

6" template wood

II. *Reference* - "Shipfitting Practice," p. 178.

IV. *Teaching Hints*

A. Safety

1. While installing ladders be sure to block off the opening.

2. Make sure the ladder is tacked securely before leaving the job.

B. Information to be presented:

1. How to install vertical ladders.

2. How to install inclined ladders.

C. Demonstration by the instructor:

1. Illustrate by using sketches how to install different types of ladders.

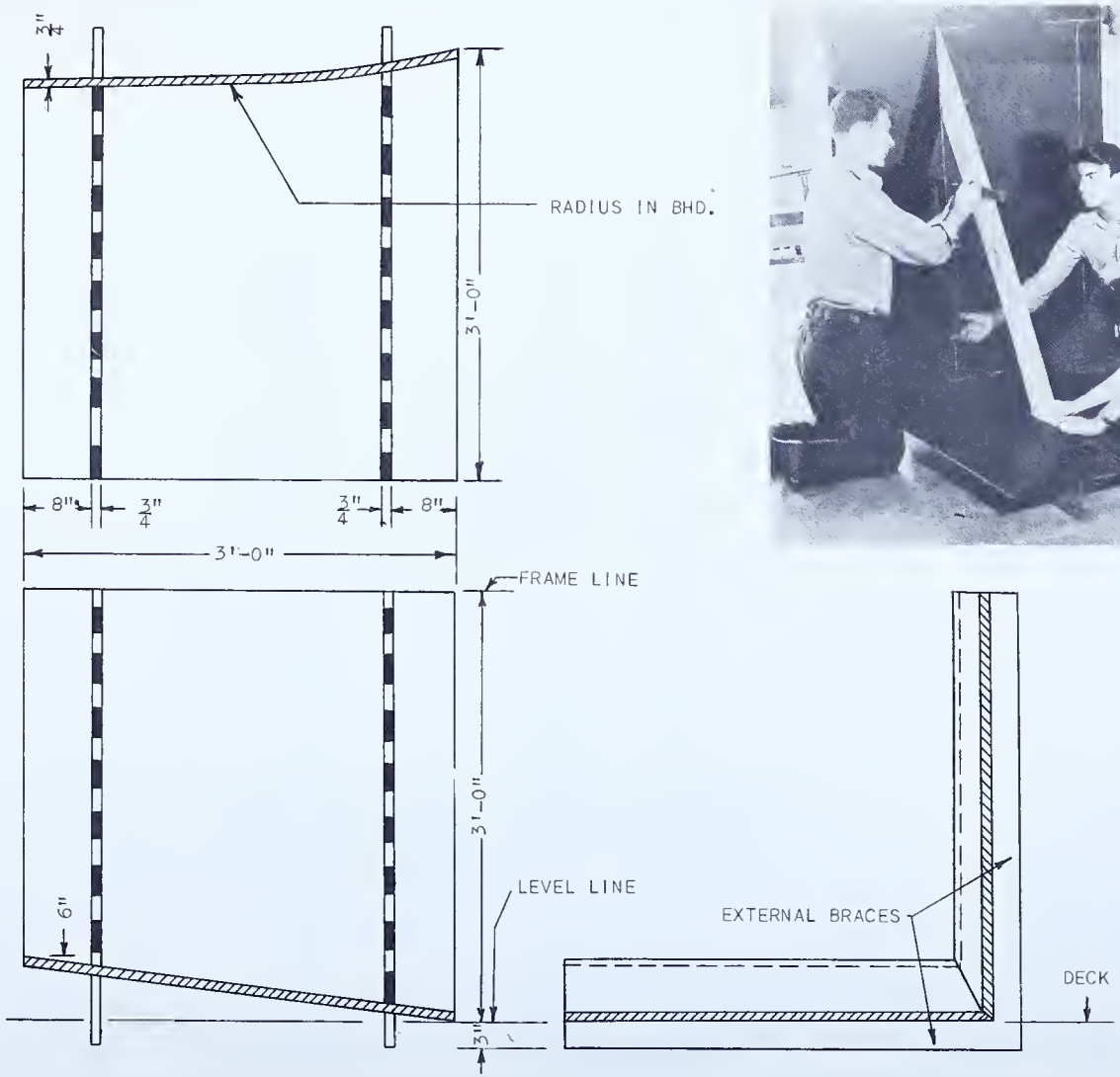
2. Demonstrate how to lift ladders on cambered deck and radius bulkhead. Use Model No. 12.

D. Student practice:

1. Lift inclined ladder from Model No. 12.

V. *Assignment*

VI. *Time* - 3 hours.


3/4"
RADIUS IN BHD.
3'-0"
8"
3/4"
3/4"
8"
3'-0"
FRAME LINE
3'-0"
6"
LEVEL LINE
EXTERNAL BRACES
DECK
3"

I. *Topic No. 25* - How to Locate and Lay Out Manholes.

II. *Tools and Equipment*

1. Rules
2. Chalk line
3. Circle torch
4. Inner bottom access blueprint
5. Raised type manhole tack-welded to piece of plate - No. 13 - Fig. 200, p. 186.
6. Bolted plate manhole, tack-welded to plate - No. 14 - Fig. 200, p. 186.

Supplies

Chalk

II. *Reference* - "Shipfitting Practice," pp. 185-187.

IV. *Teaching Hints*

A. Safety

1. Have guard rail put around holes before they are burned.

B. Information to be presented:

1. How to locate frame lines on tank top and deck.

2. Correct size to burn hole for raised type of manhole. Use Model No. 13 to illustrate.

3. Correct size to burn hole for bolted type of manhole. Use Model No. 14 to illustrate.

4. How to set a burner's torch.

C. Demonstration by the instructor:

1. Using the floor as a tank top, locate and lay out a manhole.

D. Student practice:

1. Have trainees locate and lay out manholes of various types on the floor.

NOTE: Trainees work in groups of two.

V. *Assignment*

VI. *Time* - 3 hours.

I. *Topic No. 26* · How to Locate, Lay Out, Lift, and Install Doors and Fittings.

II. *Tools and Equipment*

1. Blueprints of all types of doors
2. Dog for watertight door
3. Hook bolt for tonnage door
4. Model of non-watertight door - No. 15
5. Pocket knife
6. 2' rules
7. 6' rules
8. Hammers

Supplies

4" template wood

Tacks

III. *Reference* - "Shipfitting Practice," pp. 179-181.

IV. *Teaching Hints*

A. Safety

1. A system should be arranged so that only one man dogs in the door. This safety precaution will protect hands and fingers.
2. Hinges should be safely welded before leaving job.

B. Information to be presented:

1. Construction of non-watertight doors.
2. Clearance to allow for non-watertight door.
3. How to make template for non-watertight door.
4. How to fit locks for non-watertight door.
5. Where to locate locks for non-watertight doors.
6. How to protect locks.
7. Construction of watertight doors.
8. How to locate watertight doors.
9. How to prevent distortion due to welding.
10. How to determine height of sill.
11. Construction of gastight doors.
12. Construction of tonnage doors.
13. How to fasten tonnage doors.
14. Construction and locations of weathertight doors.
15. How to make keyholes.
16. Care of keys.

C. Demonstration by the instructor:

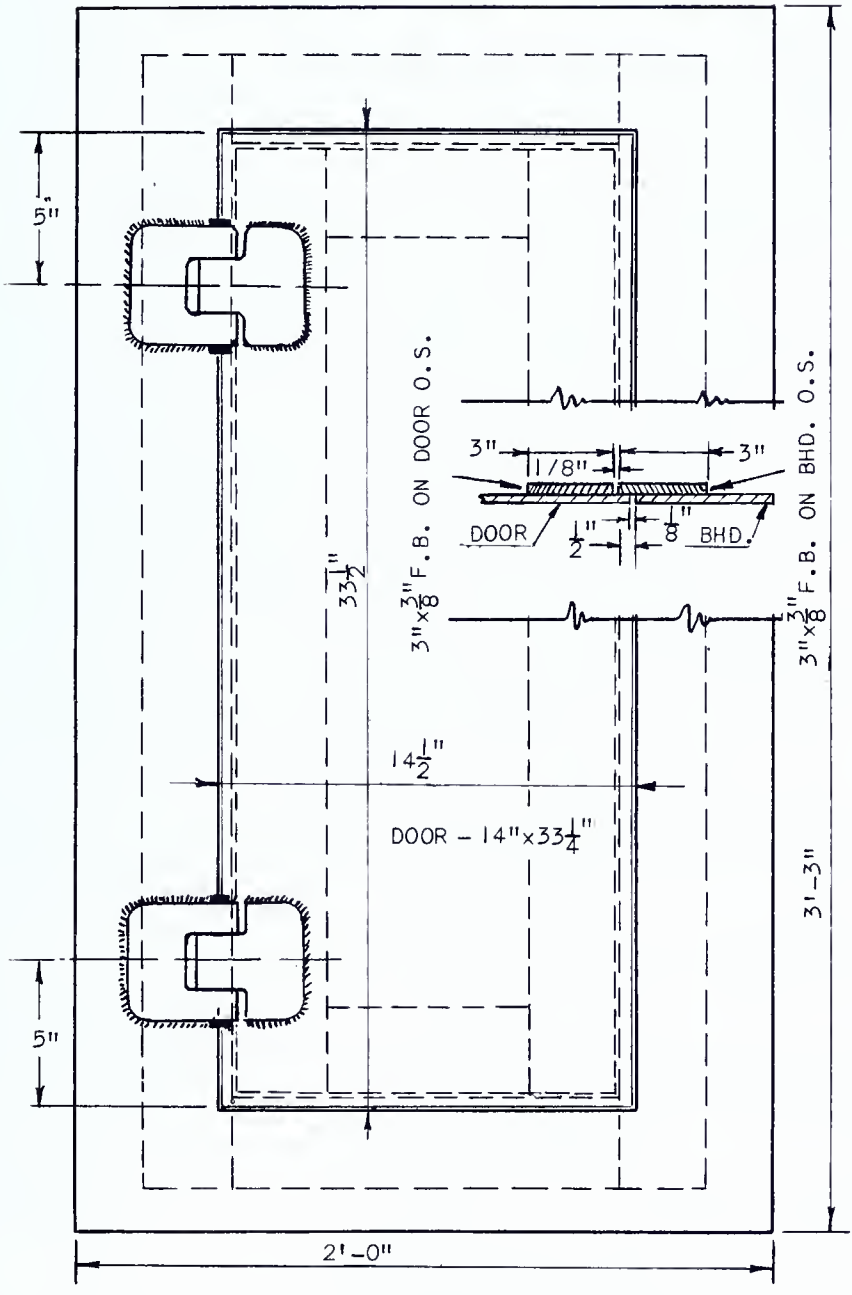
1. Illustrate, using Model No. 15, how to lift template, install door, allow clearance, protect, locate and fit locks, and drill holes for key in a non-watertight door
2. A general discussion on other types of doors will be sufficient. Use fittings for demonstration.

D. Student practice:

1. Trainees should make a template of a non-watertight door.
2. Change door to swing the opposite way. Change locks to fit
3. Trainees should change a door to swing the opposite way and change locks to fit.

V. *Assignment*

VI. *Time* - 6 to 9 hours.



NON-WATERTIGHT DOOR MODEL - NO. 13

I. *Topic No. 27* - How to Locate and Install Fittings for Rigging.

II. *Tools and Equipment*

1. Rigging drawing
2. 14" cleat
3. 1/2" cleat
4. Pad eye
5. Chain plate
6. Eye bolt
7. 2' rules
8. 6' rules

III. *Reference* - "Shipfitting Practice," pp. 188-190.

IV. *Teaching Hints*

A. Information to be presented:

1. How to locate deck pads, Fig. 204, p. 189.
2. Different types of pads.

B. Demonstration by the instructor:

1. Demonstrate how to locate deck pads.

NOTE: Location to be approved by owners' representative before final welding.

C. Student practice:

1. Identify different types of deck pads.
2. Have trainees locate deck pads.

NOTE: Several trainees demonstrate how to locate deck pads.

V. *Assignment*

VI. *Time* - 1 to 3 hours.

I. *Topic No. 28* - How to Locate and Set King Posts and Masts.

II. *Tools and Equipment*

1. 50' tape
2. Rules
3. Templates for rake of masts.
4. Plumb bob
5. Blueprints:
   a. Masts and fittings
   b. King Post and fittings
6. Declivity Model - No. 6

III. *Reference* - "Shipfitting Practice," p. 112.

IV. *Teaching Hints*

A. Safety

1. Be sure the job is properly tacked and braced before leaving it.
2. When burning holes, have man stationed below to keep other men clear.

B. Information to be presented:

1. How to figure allowance for declivity for various heights.
2. How to set burner's torch.
3. Precautions to be taken when burning through the deck.
4. How to set and dog doublers.
5. How to locate frame lines and buttocks.
6. How to make a template for finding the diameter of a King Post; and how, from the template, to lay out the hole.

C. Demonstration by the instructor:

1. Construct a mast-setting template.
2. Demonstrate how to assure a plumb king post by plumbing down from one deck to another to locate holes directly below.
3. Demonstrate setting of King Post that does not go through a deck.

D. Student practice:

1. Locate King Post and mast on floor, from blueprints.
2. Make a mast-setting template when the sheer angle and the amount of the rake are given.

V. *Assignment*

VI. *Time* - 3 hours.

I. *Topic No. 29* - How to Locate and Install Mooring Equipment.

II. *Tools and Equipment*

1. Blueprints of bitts and chocks
2. Blueprints of mooring pipe
3. Blueprints of fairleads
4. Blueprints of winches
5. Blueprints of capstans
6. Chalk line

III. *Reference* - "Shipfitting Practice," pp. 174-176.

IV. *Teaching Hints*

A. Safety

1. General safety in handling of materials.

B. Information to be presented:

1. Construction of various pieces of mooring equipment.

2. How to locate and set bitts and chocks.

3. How to locate and set mooring pipes.

4. How to locate, set, and line fairleads and fairlead foundations.

C. Demonstration by the instructor:

1. A trip to a ship with the mooring equipment completed will be advantageous at this time. Check locations and lining of various mooring equipment on board ship.

D. Student practice:

1. Have trainees answer questions on locating and setting mooring equipment.

2. Have trainees, by referring to blueprints, criticize the finished workmanship of these jobs.

V. *Assignment*

VI. *Time* - 3 hours.

I. *Topic No. 30* - How to Locate and Install Ventilating Equipment.

II. *Tools and Equipment*

1. Rules
2. Tape
3. Natural ventilation drawing
4. Mechanical ventilation drawing

II. *Reference* - "Shipfitting Practice," p. 191.

IV. *Teaching Hints*

A. Safety

1. Care to be taken when handling pipe.

B. Information to be presented:

1. Definition of natural ventilation.
2. Definition of mechanical ventilation.
3. Types of natural ventilation.
4. Installation of ventilating equipment.

C. Student practice:

1. Make layout of deck on floor, with frames and center line. Have trainees lay out for vents.

V. *Assignment*

VI. *Time* - 3 hours.

I. *Topic No. 31* - How to Locate and Install Scuppers and Freeing Ports.

II. *Tools and Equipment*

1. Rules
2. Scupper Models - No. 16
3. Pocket knife

Supplies

Strawboard

III. *Reference* - "Shipfitting Practice," p. 183.

IV. *Teaching Hints*

A. Safety

1. Precautions to be taken when burning holes.

B. Information to be presented:

1. How to locate frame lines.

2. Types of scuppers.

3. How to burn holes for welding.

4. How to set burners' torch for burning freeing ports.

5. How to design doublers for freeing ports, and scuppers

C. Demonstration by the instructor:

1. How to develop templates for scupper holes in deck and shell.

2. How to develop templates for angle and pipe scuppers.

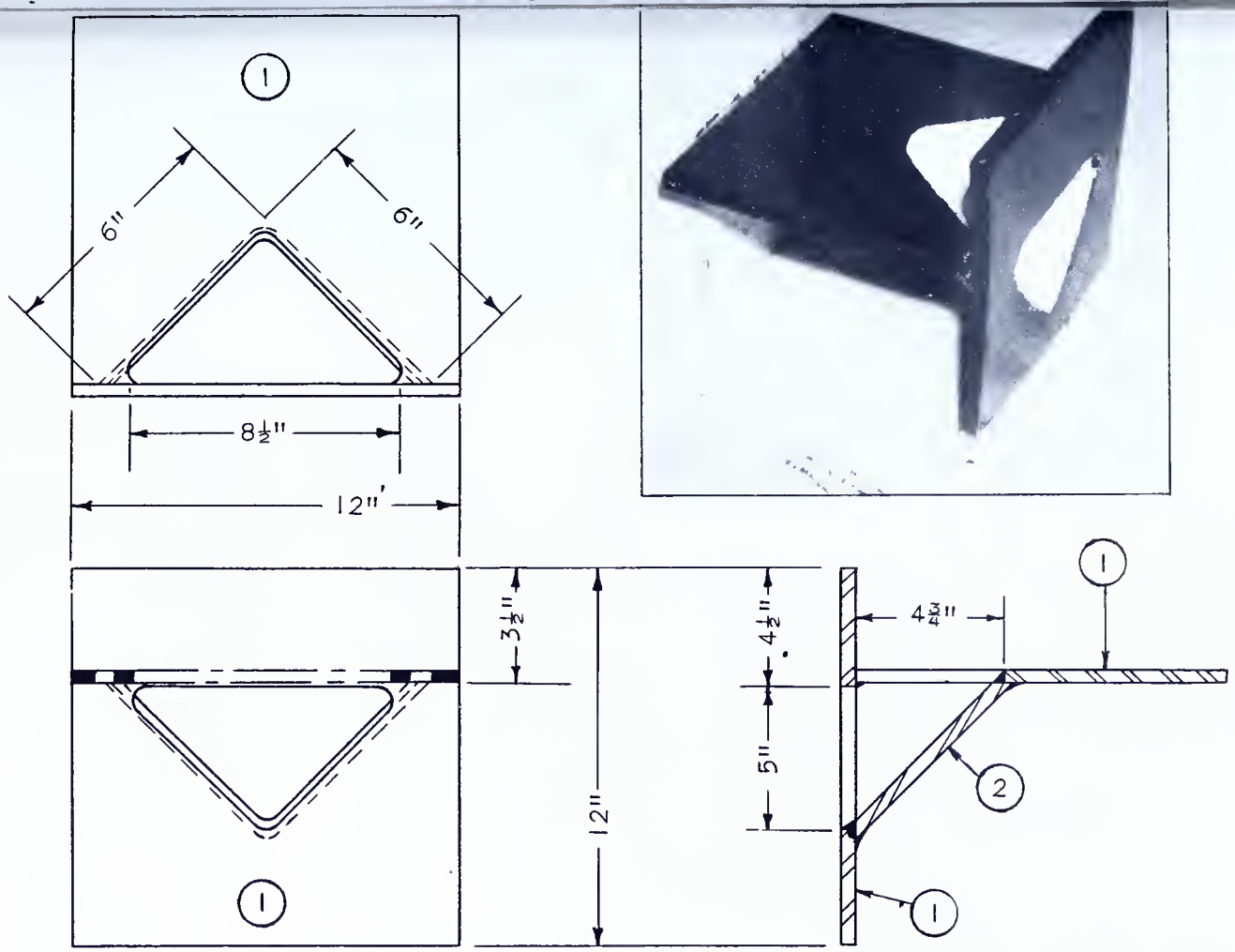
D. Student practice:

1. Have each trainee develop templates for shell and deck holes.

2. Have each trainee develop templates for angle and pipe scuppers.

V. *Assignment*

VI. *Time* - 3 hours



SCUPPER MODEL - NO. 14

I. *Topic No. 32* - How to Locate and Install Pipe Protection.

II. *Tools and Equipment*

1. Steel straight edge
2. 2' rule
3. 6' rule
4. Several sections of shaped pipe (approximately 3")

Supplies

Strawboard

III. *Reference* - "Shipfitting Practice," p. 188.

IV. *Teaching Hints*

A. Information to be presented:

1. Types of pipe protection.
2. Uses of pipe protection.
3. How to fasten pipe protection.
4. How to lay out protection for pipes having various bends.

B. Demonstration by the instructor:

1. How to lift shaped pipe protection.
2. How to lay out angles, channels, flat bars, and plate for pipe protection.

C. Student practice:

1. Trainees work individually while lifting shaped pipe protection.
2. Trainees work individually on laying out shaped pipe protection.

V. *Assignment*

VI. *Time* - 3 hours

I. *Topic No. 33* - How to Locate and Set Oil-Tight Hatches.

II. *Tools and Equipment*

1. Blueprint of Oil-Tight Hatches

II. *Reference* - "Shipfitting Practice," pp. 183-185.

IV. *Teaching Hints*

A. Safety

1. Guard rails are to be erected around holes.

B. Information to be presented:

1. How to locate holes.

2. How to lay out holes for burning.

3. How to set hatches level to the correct height.

4. How to scribe hatches.

5. Different types of hatch covers.

6. Different types of hatch cover supports.

C. Illustration by the instructor:

1. How to lay out holes for burning.

2. How to set hatches.

D. Student practice:

1. Trainees should participate in a general class discussion of this topic.

V. *Assignment*

VI. *Time* - 3 hours.

Instructor's Guide

I. *Topic No. 34* - How to Locate and Set Dry Cargo Hatches and Brace

II. *Tools and Equipment*

1. Rules
2. Hammers
3. Blueprint of dry cargo hatch

Supplies

Batten wood
Tacks

III. *Reference* - "Shipfitting Practice," pp. 183-185.

IV. *Teaching Hints*

A. Safety

1. Be sure cover is strongly braced before unhooking cran

B. Information to be presented:

1. How to lay out hatches using blueprint.
2. How to set hatch cover supports.
3. Types of dry cargo hatches.
4. How to check the sides of hatches for straightness and width.
5. Miscellaneous fittings used with dry cargo hatches.
6. How to set bracket braces on dry cargo hatches.

C. Illustration by the instructor:

1. Sketch(or have blueprints available)of all types of dry cargo hatches.
2. Explain the location and installation of each type of hatch separately.
3. Explain how to make a template for the top of the hatch so that hatch cover may be properly fitted.

D. Student practice:

1. Make template for hatch cover from lines on floor.

V. *Assignment*

VI. *Time* - 2 hours.

I. *Topic No. 35* - How to Locate and Install Equipment for Navigating Lights.

II. *Reference* - "Shipfitting Practice," pp. 187-188.

III. *Teaching Hints*

A. Safety

1. Take proper precautions when installing light brackets on masts.

B. Information to be presented:

1. Definitions, locations, and uses of the various pieces of navigating equipment.

2. Why range lights are shielded.

3. How to screen running lights.

4. Importance of proper screen on running lights.

5. How to install light brackets on masts.

C. Demonstration by the instructor:

1. At the completion of the course, a second trip to a nearly finished ship will be of value. This topic should be discussed in full at this time.

D. Student practice:

1. Trainees will ask and answer questions on trip to ship.

IV. *Assignment*

V. *Time* - 1 hour.

I. *Topic No. 36* - How to Develop a Cylinder.

II. *Tools and Equipment*

1. 2' rules
2. Claw hammer
3. Penknife
4. 6' rules

Supplies

Tacks

Paper

Red template paper

III. *Reference* - "Shipfitting Practice," p. 197.

IV. *Teaching Hints*

A. Information to be presented:

1. Relation of neutral surface in rolling steel.
2. How to make roll set template.
3. Breaking edges to be rolled.

B. Illustration by the instructor:

1. Compute, on blackboard, diameter and circumference of neutral surface of a rolled plate.
2. Explain laying out length of neutral surface circumference on flat plate to be rolled for riveted and welded work.

C. Student practice:

1. Students make template for rolled plate 15" O.D. x 6" x 15.3#.

   (If possible, a plate should be laid out and rolled, and returned to the classroom.)

V. *Assignment*

VI. *Time* - 1 to 2 hours.

I. *Topic No. 37* - How to Develop the Frustum of a Cone.

II. *Tools and Equipment*

1. Dividers, or trammel points
2. Steel straight edge
3. Chalk line
4. Hammers
5. Pocket knife

Supplies

Chalk

Red template paper

Tacks

III. *Reference* - "Shipfitting Practice," pp. 198-199.

IV. *Teaching Hints*

A. Information to be presented:

1. Definition of frustum.
2. Uses of this development aboard ship.

B. Illustration by the instructor:

1. Illustrate procedure, pp. 198-199, bringing out importance of neutral surface.

C. Student practice:

1. Have trainees develop a frustum of a cone.

V. *Assignment*

VI. *Time* - 3 to 6 hours.

Instructor's Guide

I. *Topic No. 38* - How to Lay Out a Camber Curve.

II. *Tools and Equipment*

1. Dividers or trammel points
2. Steel straight edge
3. Chalk line
4. Hammers

Supplies

Chalk

Red template paper

Tacks

III. *Reference* - "Shipfitting Practice," pp. 204-205.

IV. *Teaching Hints*

A. Information to be presented:

1. How and where to use this layout in shipfitting.

B. Illustration by the instructor:

1. Illustrate how to lay out a camber curve following procedure as given in text.
2. Illustrate other methods for laying out camber curve.

C. Student practice:

1. Have trainees work individually on laying out a camber curve on red template paper. Dimensions to be given by the instructor.

V. *Assignment*

VI. *Time* - 2 to 3 hours.

I. *Topic No. 39* - How to Develop a Cylinder with a Sloping Top.

II. *Tools and Equipment*

1. Dividers
2. Steel straight edge
3. Chalk line
4. Penknife
5. Hammers

Supplies

Tacks
Red template paper
6" template wood
Fairing batten

III. *Reference* - "Shipfitting Practice," pp. 200-204.

IV. *Teaching Hints*

A. Information to be presented:

1. Relation of neutral surface in rolling steel.

2. How to make roll set templates.

B. Illustration by the instructor:

1. Develop a cylinder using neutral surface of plate.

2. Explain how to lay out a plate using neutral circumference as length of plate.

3. Explain how to divide circumference of pipe into equal parts.

C. Student practice:

1. Have trainees lay out and develop a cylinder with a sloping top on red template paper.

   NOTE: Dimensions to be given by instructor.

2. Have trainees make roll set templates using template wood.

V. *Assignment*

VI. *Time* - 6 to 9 hours.

Instructor's Guide

I. *Topic No. 40* - How to Construct an Ellipse.

II. *Tools and Equipment*

1. 2' rules

Supplies

Thin fairing batten
Red template paper

III. *Reference* - "Shipfitting Practice," pp. 205-206, Fig. 215.

IV. *Teaching Hints*

A. Information to be presented:

1. Uses of this development by shipfitters.

B. Illustration by the instructor:

1. Illustrate how to construct an ellipse.

C. Student practice:

1. Have trainees work individually on constructing an ellipse.

V. *Assignment*

VI. *Time* - 2 to 3 hours.

I. *Topic No. 41* - How to Develop a Right-Angle Intersection of Two Cylinders.

II. *Tools and Equipment*

1. Claw hammer
2. 2' rules
3. 2' square
4. Chalk line
5. 3 awls
6. Dividers or trammel points
7. 6' rules

Supplies

Red template paper
Tacks
Chalk

III. *Reference* - "Shipfitting Practice," pp. 201, 202.

IV. *Teaching Hints*

A. Information to be presented:

1. How to use neutral surface in rolling.

2. How to make roll sets.

B. Illustration by the instructor:

1. Lay out cylinder intersection on blackboard.

NOTE: Dimensions to be given by the instructor.

2. Explain the procedure for developing a right-angle intersection of two cylinders.

C. Student practice:

1. Lay out cylinder intersection on floor to neutral surface.

2. Lay out circle to neutral surface.

3. Develop the hole in the large cylinder for the intersecting cylinder.

4. Develop the intersecting cylinder.

V. *Assignment*

VI. *Time* - 3 hours.

PAMPHLET BINDER
Manufactured by
GAYLORD BROS. Inc.
Syracuse, N. Y.
Stockton, Calif.